SCIENCE LIBRARY

McGRAW-HILL PUBLISHING COMPANY, INC.

NOVEMBER 12, 1927

NOV 15 1927

NOV 15 1927

TWENTY-FIVE CENTS PER COPY

ENGINEERING AND MINING JOURNAL

A Consolidation of Engineering and Mining Journal and Mining and Scientific Press

METAL AND NON-METALLIC MINING · MILLING · SMELTING · REFINING · MARKETING

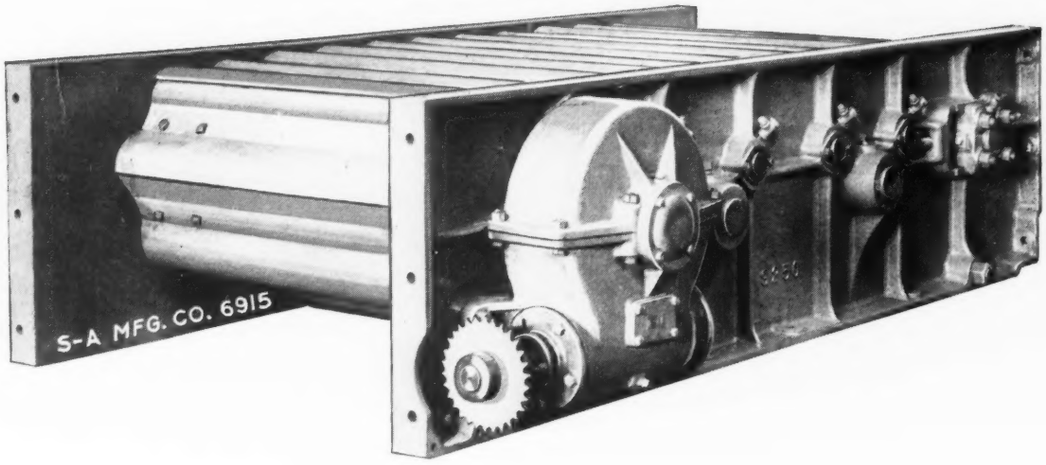
Geophysical Exploration for Ores, by Dr. Max Mason

How Far Can Mining and Quarrying Be Mechanized? by George J. Young

Recovering Tin from Tailings—*An Example of Modern Practice*—by E. G. Lawford

The Auriferous Alluvials of Colombia, by Mariano Ospina Pérez

This unit type feeder *has a number of advantages*



Giant Slide Gate

Powerful Closing Action

This is a standard style No. 10-D Slide Gate with double rack and pinion operating mechanism, roller guides and spout cast integral with frame. Completely shown on page No. 422 of Stephens-Adamson new General Catalog No. 30.

Among the numerous types of S-A Ore Feeders ranging from small self-contained types to units capable of handling carloads of heavy ore, the special S-A Unit Pan Feeder shown above is an excellently designed, self-contained roller track type.

This special unit pan feeder is especially useful where a battery of feeders are in use, due to the fact that it can be easily removed for adjustment or repair and replaced with a spare feeder.

It is especially designed for continuous duty, with high-grade bearings bronze bushed throughout. The overlapping steel pans are mounted upon strands of steel bar roller chain and may be armored for protection against shock and abrasion.

By using the roller track principle the supporting chains are relieved of practically all wear except that caused by the slight bend around sprockets. The wide-shouldered rollers, mounted upon cross shafts, are carried in large bearings which are easily lubricated.

STEPHENS-ADAMSON MFG. CO., Aurora, Ill.

Designers and Manufacturers of Conveying, Elevating and Transmission Machinery

Factories at: **Aurora, Ill. Los Angeles, Calif. Belleville, Ont., Canada**

Branch Offices in All Principal Cities

STEPHENS-ADAMSON

S-A BELT CONVEYORS

Volume 124 New York, November 12, 1927 Number 20

ENGINEERING AND MINING JOURNAL

A. W. ALLEN, *Editor*

Associate Editors
E. H. ROBIE A. H. HUBBELL
A. B. PARSONS
GEORGE J. YOUNG, San Francisco

Contributing Editor
T. A. RICKARD, San Francisco
Assistant Editors
W. N. P. REED H. D. KEISER

Contents

Editorials 761
- Secrecy in Geophysical Exploration
- The Lack of Reflective Thinking
- Expanding the Consumption of Metals
- "Plumping" for Copper Mines
- On the Value of Repetition
- New Library at the University of Nevada
- The Vicissitude of the Borax Miner
- Deep-hole Drill Prospecting
- An Important Mining Industry Emerges from the Doldrums

***In the Nevada Consolidated Pit at Ruth** 765
Illustrations

***Geophysical Explorations for Ores** 766
By Dr. Max Mason

Europe Making Economic Recovery 771

***The Auriferous Alluvials of Colombia** 772
By Mariano Ospina Pérez

***An Example of Modern Practice in the Recovery of Tin from Tailing** 773
By E. G. Lawford

How Far Can Mining and Quarrying Be Mechanized 775
By George J. Young

Useful Operating Ideas 780
- *Standard Curve Computations
  By A. D. Rood
- How to Straighten Gyratory Shafts
  By C. B. Strachan
- Temperature of Solutions Flowing in Pipes
  By Charles Labbe

Mining News 782
- J. W. Furness Appointed Chief of Minerals Division
- Soviet Metallurgists Visit Butte
- Fire Held Responsible for Quincy Blast
- More Brokerage Houses Raided in Ontario
- Prospectors Enter New District in Alaska

Societies, Addresses and Reports 788
- The Eastern Tour of the Empire Mining Congress
  By F. Lynwood Garrison

Personal Notes 791

Obituaries 791

Imports and Exports of Ores and Metals in August and September, 1926 and 1927 792

Market Report 793

Metal Price Curves 795

Review of Current Statistics 796
By A. B. Parsons

E. & M. J. Statistics of the Mining Industries 797

Mining Stocks 798

Industrial Progress 799

Professional Directory 45-47

Searchlight Section 49-51

What and Where to Buy 52-54

Advertising Index 56

*Illustrated Article

McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Ave. at 36th St., New York, N. Y.

JAMES H. McGRAW, President
JAMES H. McGRAW, Jr., Vice-Pres. and Treas.
MALCOLM MUIR, Vice-President
EDWARD J. MEHREN, Vice-President
MASON PRITTON, Vice-President
EDGAR KOBAK, Vice-President
C. H. THOMPSON, Secretary

NEW YORK District Office, 285 Madison Ave.
WASHINGTON, National Press Building
CHICAGO, 7 S. Dearborn Street
PHILADELPHIA, 1600 Arch Street
CLEVELAND, Guardian Building
ST. LOUIS, Bell Telephone Building
SAN FRANCISCO, 883 Mission Street
LONDON, 6 Bouverie St., London, E. C. 4

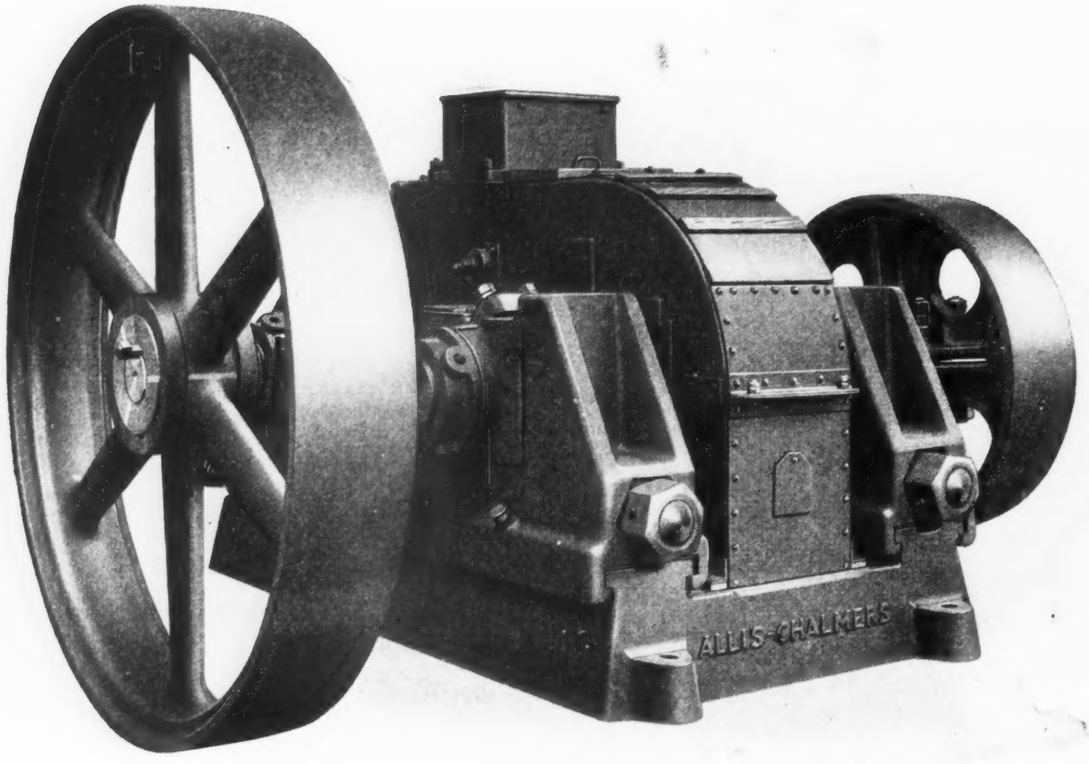
Cable Address: "Machinist, N. Y."
Copyright 1927
By McGraw-Hill Publishing Company, Inc.
Publishers of

Engineering News-Record American Machinist
Power Chemical and Metallurgical Engineering
Coal Age Engineering and Mining Journal
Coal Age News Ingenieria Internacional
Electrical World Electrical Merchandising
Bus Transportation Electric Railway Journal
Industrial Engineering Radio Retailing
Construction Methods Electrical West
(Published in San Francisco)
American Machinist—European Edition
(Published in London)

The annual subscription rate in the United States, Canada, Mexico, Alaska, Hawaii, Philippines, Porto Rico, Canal Zone, Honduras, Cuba, Nicaragua, Peru, Colombia, Bolivia, Dominican Republic, Panama, El Salvador, Argentina, Brazil, Spain, Uruguay, Costa Rica, Ecuador, Guatemala, Chili, Haiti and Paraguay, $5 per year. Extra foreign postage, $3 (total $8 or 34 shillings). Single copy, 25c. Change of Address—When change of address is ordered the new and the old address must be given. Notice must be received at New York at least ten days before the change takes place.
Published weekly. Entered as second-class matter, June 20, 1879, at the Post Office at New York, N. Y., under the Act of March 3, 1879.
Printed in U. S. A.
Member Audit Bureau of Circulations.
Member Associated Business Papers, Inc.

11,749 Copies Printed This Issue

TYPE "B"
CRUSHING ROLLS



FOUR SIZES

Meet the Most Exacting Demands as to Duty, Efficiency and Reliable Service

ALLIS-CHALMERS
MILWAUKEE, WIS. U. S. A.

ENGINEERING AND
MINING JOURNAL

McGraw-Hill Publishing Company, Inc.
JAMES H. MCGRAW, *President*

A. W. ALLEN,
Editor

VOLUME 124 — *New York, November 12, 1927* — NUMBER 20

Secrecy in Geophysical Exploration

SECRECY as to the results obtained by the use of geophysical methods of prospecting is the greatest obstacle to their development and application in the search for ore. The practical value of these methods under varying conditions has been demonstrated. They need further testing. The art of using them is comparatively new. More knowledge is desirable. The mining company that imposes secrecy on the firm of exploration engineers and physicists engaged to prospect its ground is thoughtlessly impeding progress.

What has a company to gain by such secrecy? Possibly the opportunity to acquire adjacent ground, if such acquisition seems desirable. What, on the other hand, has it to lose? No geophysical method will detect ore, as Dr. Max Mason, president of Chicago University, maintains in a scholarly and interesting paper to be found elsewhere in this issue. No electrical prospecting method will determine the character or value of a mineralized area, as the Radiore Company straightforwardly declares in its advertisements. An electrical method can do no more than disclose the existence and approximate position of a conductor. Indeed, the existence of ore can be demonstrated only by drilling or digging. Thus the advantage of being able to acquire adjacent ground is seen to be of slight importance.

The publication of the results of geophysical prospecting by various methods will influence many operators to give them all a trial. Those who have employed one method without success will be tempted to try others. Thus each method will be tested under a wide variety of conditions; and, as a result, the knowledge of the art, as well as of the science on which the art is based, will grow. The mining industry as a whole will profit.

A firm stand against secrecy has been taken by at least one of the geophysical exploration companies. This organization, the Radiore Company, refuses to undertake work of this character unless the company seeking its services consents to full publicity. Every contract entered into since June, 1927, contains this clause:

"The party of the first part further agrees to give the party of the second part full benefit of all publicity regarding the results obtained by the Radiore electrical survey and to permit free publication, in such manner as the party of the second part may designate, of information and data concerning the survey and the indications, if any, of all underground conductors on the property."

This action of the exploration company is as sensible as it is novel. It has helped the company's business and advanced the art. Under such an arrangement as this all the cards are on the table, and in the light of adequate publicity there is no opportunity for hocus pocus. Doubtless, other geophysical exploration companies might take a similar step to the advantage of all concerned.

The Lack of Reflective Thinking

IT IMPRESSES Doctor Butler, of Columbia, as odd that there should be so little thinking among the American people, intellectually curious as they are and addicted to schools and libraries. Their search for information, he says, is conducted mostly by the aid of popular and superficial books, of fugitive articles in magazines and newspapers, and of popular lectures of dubious value. "It may well be," he ventures, "that an excess of information, acquired with too great rapidity, clogs the road to reflective thinking and either prevents or unduly postpones it."

A fair criticism and difficult to deny. Much evidence exists to prove it. The mistake of assuming that intellectual heights have been reached is easily made: the popularity of education; the crowded schools and colleges; a show of knowledge among the masses and a glib familiarity with various facts of spectacular invention and achievement—all these are quite misleading. The display of learning betokens merely a capacity for absorbing facts, not the ability to think reflectively.

If the people thought for themselves would they be so easily swayed by propaganda? Could a demagogue weave his spell? Witness the power of the yellow press and of much nonsensical advertising; or the ability of the cinema to make heroines from mediocrity. Witness the acquiescence of a society's members to management by self-appointed autocrats; or the blind acceptance of principles formulated in the interest of a few.

Failure to think is not limited to any particular stratum of the social structure. Even in the highest products of the colleges it may be noted. Of more immediate concern, it is visible in the theory that an intensive education in the memorizing of facts will insure ability to solve the practical problems of life.

What would happen if the majority began to think? The results would be incalculable. How, then, may men be persuaded to practice thinking? Adversity would help. Prosperity breeds thoughtlessness. Schools of reason might be established, capping the educational structure. Into them the graduates from below, stuffed with facts, might go to learn to use their brains.

Expanding the Consumption of Metals

PRODUCERS of raw materials, such as the metals, do not have the opportunities that are enjoyed by most manufacturers for expanding their business. The copper refiner, for example, has little hope of increasing the consumption of the metal by improving the purity of the product, for it is already 99.9+ per cent pure and a further removal of contami-

nants would not be economically justifiable. Neither can he accomplish much in suggesting new uses for copper ingots, wirebars, and other shapes: they are merely used for making brass or other alloys, copper wire, sheet copper, and similar well-recognized materials of construction; and considerable difficulty would be found in devising a new and useful shape in which refined copper might be sold or a new use to which it might be put. No, for the expansion of the uses of copper, the copper-producing industry must depend upon the efforts of manufacturers of brass pipe in getting plumbers to use their product more widely; on the efforts of rollers of sheet copper to have more copper store fronts; and so on. In other words, the efforts made by the copper producer to expand his market must be indirect and varied; he should, for instance, be in favor of a canary bird in every home, thereby increasing the sale of bird cages and the brass wire and ingot copper from which they are made.

It is only fair that the producer of a metal should give encouragement and thought to increasing the uses of the ultimate metallic products, for he will benefit indirectly at least. Such support is being given through memberships in an organization such as the Copper and Brass Research Association. But the metal producer can go even further. Each mine, mill, smelter, and refinery may be made to a certain extent a commercial testing laboratory, in which may be tried out the various manufactured products utilizing the metal produced there. For example, valuable co-operation might be given to the paint industry, which offers an important outlet for many metals, there being a wide field for experiment in ascertaining the best paint for a given purpose. The lead smelter might well buy various kinds of lead-containing paint and co-operate with the paint manufacturer in finding what is the best for various purposes, rather than to buy any kind of paint without a thought as to its composition. Likewise with copper, zinc, and aluminum. It is now generally recognized that the efficiency of paint on wood surfaces, and to some extent on other surfaces as well, depends largely on its moisture-excluding property. The aluminum producers have developed the use of a priming coat of aluminum paint with excellent results, thus achieving a covering that is impermeable to moisture, especially effective in preventing wood weathering, and very durable. Perhaps finely divided forms of other metals might be used to advantage. This is only one field in which the mining industry might assist in developing outlets for its products. Many others will suggest themselves.

"Plumping" for Copper Mines

ENGINEERING AND MINING JOURNAL "plumps" for Utah as the world's premier copper mine according to the *Mining and Industrial Magazine* of South Africa. It reprints our August 20 editorial on the subject; and then, granting the accuracy of all that is said, proceeds to sing a song in behalf of the Union Minière as the leading copper mine. In all such discussions everything depends on the way the superlative adjective, whatever it may be, is defined or qualified. In the editorial it was specified that Utah was given the foremost place because it is today making more money for its shareholders than any other. *Today,* mind you. Possibly, as the South African editor suggests, when transportation has been provided to Lobito Bay and Bas Congo, and the Union Minière's immense freight costs are reduced, it will outdo Utah in the matter of net earnings. But by that time Utah may be doing better, too. And there are others to consider. Later on, says our friend from the Dark Continent, Union Minière will probably produce at the rate of 30,000,000 lb. per month. Chile Copper is equipped today, in all essential respects, to turn out 31,250,000 lb. of copper monthly. Incidentally, if the yardstick be low production costs Chile holds first place, for it can deliver a pound of refined copper to the consumer more cheaply than any other producer of ores that can be classed strictly as copper; but Chile's capital structure is such that charges for interest increase the over-all cost of production. Anaconda, at Butte, at one time produced at the rate of more than 25,000,000 lb. of copper per month, which is the best record ever made and gives Anaconda a claim to a place in the sun among copper mines. At the present time Utah, Anaconda, and Chile all three are operating at much less than their maximum capacity; whereas it is generally understood that the Union Minière is doing its utmost. There is plenty of credit to go around; but we still stand by the statement that *at the moment* Utah leads them all as a moneymaker—and incidentally, it is treating ore far leaner than any of its competitors.

On the Value of Repetition

A READER in Holland writes to suggest that the value of many technical articles would be enhanced if they contained references to former articles on the same subject. The point, which is worthy of elaboration, is well taken, and we are glad of an opportunity to give the idea wider publicity. It is not always practicable to publish a bibliography with every article, but the desire for further research on the part of the reader is often overlooked in the haste to present new data and new conclusions. Specialists forget sometimes that few readers of a publication covering so wide a range of subjects as does *Engineering and Mining Journal* are even slightly acquainted with the prior state of the art in question, but it is obvious that no scientific appraisal of the worth of a development can be made unless the reader possesses or can easily acquire a background of fundamental knowledge on the subject. As engineers speaking to an immense audience scattered through almost all the progressive countries of the civilized world, it behooves us to appreciate the position of the reader in Holland, for example, who is doubtless tantalized by the fact that he has no basic setting in which to place a valuable new item of knowledge. Without undue elaboration it is usually possible to sketch briefly the developments leading up to the evidence and conclusions that justify reopening a subject, thereby whetting the interest of even those who otherwise would consider the article outside their field.

Repetition is often well worth while, especially when it emphasizes the truth of a fundamental fact on which a logical scheme of reasoning and development should be based. A specialist in any field should be more than willing to encourage in others the spirit of research that helped him to reach his own goal; and, with a thorough knowledge of the subject, he is in the best position to summarize the various steps that have contributed to ultimate achievement.

As we have emphasized before, if technical journalism is to fulfill its high purpose, it must step aside occasionally from an emphasis of the up to date, in order to impress on all and sundry the vast importance of those elementary facts and common-sense principles that, one must confess, are often overlooked.

New Library at the University of Nevada

THE DEDICATION of the new Alice McManus Clark library building at the University of Nevada on Oct. 21, 1927, is of interest to the mining fraternity, as the building has been erected in memory of the wife of William A. Clark, Jr., who was born at Virginia City and was educated in the Nevada schools. She died in 1918. The provision and endowment of a university library constitutes an eminently practical philanthropy. The University of Nevada is to be congratulated on receiving a needed enlargement of its educational facilities.

It is worthy of note that part of the fortune of the late William A. Clark has gone to a mining state and for such purposes. The doner is William A. Clark's son The fortunes of the Clark family were derived from mining, and the estate continues to control important mining properties. In 1908 Clarence M. Mackay, likewise the son of one of the mining pioneers, and his mother gave, in memory of William H. Mackay, a mining building and an athletic field, as well as a substantial endowment for the Mining School of Nevada. The Mackay fortunes originated from mines upon the Comstock.

Both William A. Clark, Jr., and Clarence M. Mackay could not have found a better philanthropy than gifts to be devoted to the cause of advanced education. In the one it was a graceful recognition of the birthplace of a revered wife, and in the other gratitude to a state that had furnished opportunity to an energetic and resourceful miner. There is an obvious suggestion in this to other successful miners and to the daughters and sons of pioneers who won fortunes in mining.

The Vicissitudes of the Borax Miner

THE shifting of borax-mining operations in the Death Valley section of California by the Pacific Coast Borax Company to the vicinity of Kramer, in the Mohave Desert region, where the company has opened up a large deposit of a new borax mineral closely approximating ordinary borax in composition, illustrates the almost kaleidoscopic changes that sometimes occur in the mining industry. Playa deposits were first worked in Death Valley for their borax content. Colemanite in commercial quantity was afterward discovered in the Furnace Creek area and at several places in the Mohave Desert. These deposits were exploited and the playas became deserted. An important plant was established and operated in the vicinity of Death Valley Junction until recently.

Search for potash about fifteen years ago resulted in the discovery of the Searles Lake deposits; and, eventually, chemical engineers succeeded in developing methods for the production of potash and the accessory by-products, among which was borax. An industry was established, and the product came into severe competition with the borax produced from the colemanite deposits. In the meantime, another large colemanite deposit had been discovered in southern Nevada east of Las Vegas, and production was started. In spite of new uses for borax, the market was more than generously supplied, and the colemanite-mining companies were compelled to operate on a narrow margin of profit, necessitating drastic economies. The situation has now been changed in part by the discovery of a large deposit of the new mineral rasorite. This development doubtless is responsible indirectly at least for the recent reduction in the market price of borax, at Pennsylvania plants, from $4\frac{1}{4}$ to 4c. per pound for crystals in carload lots. Pacific Coast Borax has the "edge" on its competitors. However, other uses may be found for colemanite, and the mining of this once-important mineral may not be abandoned. Experiments are being made with it as a glaze for pottery and as a flux in smelting operations. Improvements will undoubtedly be made in treating the mineral for the recovery of borate content. Thus its competitive position may be restored at least to some degree.

Underground Prospecting by "Deep-Drill" Methods

PROSPECTING by means of deep-hole drilling, described several years ago in the *Engineering and Mining Journal* and elsewhere, is receiving considerable attention. Tonopah is one of the latest to utilize the idea. At the Belmont property, deep-hole drilling from a network of mine workings resulted in the disclosure of orebodies that probably would not otherwise have been discovered. During 1926 an aggregate of nearly twenty thousand feet, in more than two hundred holes, was drilled. Reports are current that a large area in the Goldfield district has been leased, to be explored by the deep-hole method from the old workings of the Goldfield Consolidated Company's property.

On ground contiguous to the Goldfield Consolidated, another company, Goldfield Deep Mines Co., has sunk an exploratory shaft 2,160 ft. in depth and is extending a crosscut from the 2,100 level after making several diamond-drill holes from the bottom of the shaft. Thus two distinct plans are under way, one to explore for undiscovered oreshoots in intermediate ground by deep-hole drilling, and the other to explore vein systems at depth by crosscutting and drifting. The outcome will be awaited with interest by mining engineers; if it is successful, attention will be redirected to the potentialities of this area.

Deep-hole drilling is an economical method of exploring fault zones, testing the probabilities of parallel shoots, and determining the limits of ore. Improvements in mechanical equipment and greater experience in operation have reduced costs under favorable conditions to about one dollar per foot. Mining practice has thus advanced so that it is feasible to explore a partly exhausted ore zone at comparatively small cost. The method might well be advantageously used more extensively in the initial development of an orebody or a series of contiguous orebodies.

An Important Mining Industry Emerges From the Doldrums

INDUSTRIAL DEPRESSIONS generally occur in cycles, an observation that is particularly true in regard to the Chilean nitrate industry, which is for the moment a center of interest because of increased sales and a healthy upward price trend. This industry, which draws upon one of the richest and most valuable mineral deposits in the world and ranks in normal times as the first in economic importance in South America, has been the victim of persistently destructive propaganda. As far back as 1898, Sir William Crookes, the eminent physicist, shared honors with Louis de Rougemont, later unmasked as an adventurer, in hypnotizing the British Association for the Advancement of Science and startling the world. Sir William predicted the early exhaustion of the Chilean nitrate beds, which he had never visited; and de Rougemont described an amazing but fictitious series of adventures in Northwest Australia, which were conceived and born in the prosaic confines of the British Museum Library. For twenty years or more the Crookes prophecy served to discourage outside initiative in the technical progress of the Chilean industry, and the canard was not laid to rest until 1920 or so, when the fact was accepted that the reserves were adequate for several generations.

THE part that Chilean nitrate played in the winning of the War is well known, but the isolation of Germany during that great event was also a compelling factor in the development of synthetic substitutes, progress in the manufacture of which has constituted a technical triumph. But such products are, be it noted, substitutes, for some purposes equally as suitable as, for other purposes of doubtful interchangeability with, natural sodium nitrate. Nitric acid, for instance, can be manufactured successfully from synthetic ammonia; but sulphate of ammonia has yet to be proved a desirable substitute for Chilean nitrate as a fertilizer. Recent reports indicate that France is realizing this fact, evidenced by increased consumption of natural nitrate. Complaints are general in the cotton fields; and the turning point is being reached, with the result that the Chilean product is again coming into favor, as evidenced by increased demand and higher prices. Competition between the natural and artificial products has been keen, but the situation has been characterized by lop-sided and partial propaganda. The efforts of the Chilean industry to protect itself have been feeble in the extreme, constructive policies and vigorous propaganda being conspicuous by their absence.

IN RECENT years we have heard much loose talk about "synthetic nitrate," whereas it should be well known that the majority of synthetic products bear no comparison, chemically speaking, with Chilean nitrate of soda. The limit of parallel application of natural and synthetic nitrogen compounds has therefore escaped the attention it deserves. Pessimism in natural nitrate circles has been largely responsible for the lengthy duration of the recent slump, coupled with the determination on the part of so many producers to ignore the benefits to be derived from research and the application of modern methods. The recovery of the industry and the advance in price followed close on removal of sales control by the Nitrate Producers' Association. This upward price trend has been contrary to prophecy. What caused the appreciation? The stimulation of demand that followed the introduction of the policy of unrestricted selling helped to strengthen the market; but, basically, it is due to the superiority of Chilean nitrate in the fertilizer field and to the fact that Chile possesses a world monopoly of a product used extensively in time of war and equally valuable to insure continuous maximum agricultural production in time of peace. Natural nitrate enters another era of productiveness and prosperity in spite of itself, in spite of its pretended disdain of contemporary technical advance, in spite of well-organized and subsidized and propagandized efforts in the synthetic industries, in spite of onerous taxes.

WHAT of the nitrate export tax? The recent price advance is illuminating from more than one angle. However much everyone else concerned may have wished that it be reduced, the Chilean government has displayed unwavering firmness in maintaining its stand against any trend of this character. And the prospect of successfully shifting the onus of responsibility to official shoulders in the event of another nitrate slump is vanishing into the dim future. Reports are current that oficinas are being reopened, and it is certain that enough rich material still is available to justify operations and to insure profit, even by the utilization of an antiquated process that recovers little more than half the nitrate in the treated caliche, which is selected by hand and at considerable expense. If commercial success can be achieved under such conditions, what limit can be placed on the opportunity for profit in the wider exploitation of the untouched deposits and of the vast amount of semi-treated material available, by the use of labor-saving machinery, and the application of scientific and approved processing methods? The scope for technical skill and modern equipment has never been equaled in the history of mining enterprise.

WHAT of the future? Each succeeding slump in Chilean nitrate has been more serious that its predecessor, because of the decreasing scope for profligacy of exploitation in rich ground. The end of expensive, unscientific, inefficient methods of mining and processing is not in sight, because it is still practicable on some properties to "pick the eyes" out of the pampa, accept a loss of 40 per cent or so in treatment by primitive methods, pay the exorbitant tributes to the Chilean government, and to labor laws, and still show a profit per unit of nitrate recovered. The time is not far distant, however, when it will be necessary for the industry as a whole to follow the example of its competitors, to offer protection and encouragement to technical improvement, and turn to work in earnest on the recovery of nitrate from the vast reserves of low-grade material that exist. This will open up avenues of opportunity for engineers and operators who have served an apprenticeship in the more progressive mining and metallurgical industries, and for the utilization of large amounts of modern labor-saving equipment.

DAILY the world's need for nitrogenous products is increasing. An ample market exists in some fields for natural nitrate, and an equal opportunity presents itself for each member of the family of synthetic products in other fields. An obituary notice on one of the most important South American mining industries is not yet justified, despite the technical success of its chief competitors.

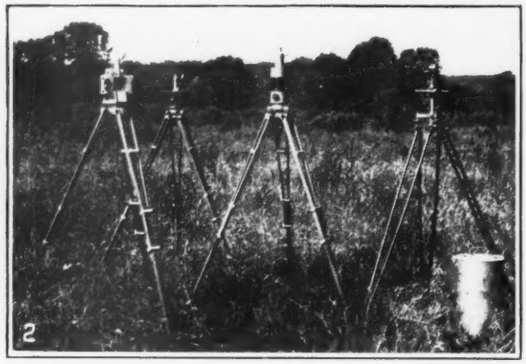
In the Nevada Consolidated Pit at Ruth, Nevada

A crane and stripping shovel at work

About 20,000,000 tons of ore has been mined from this pit, and at least 70,000,000 tons remains

Geophysical Exploration for Ores

By Dr. Max Mason
President of the University of Chicago



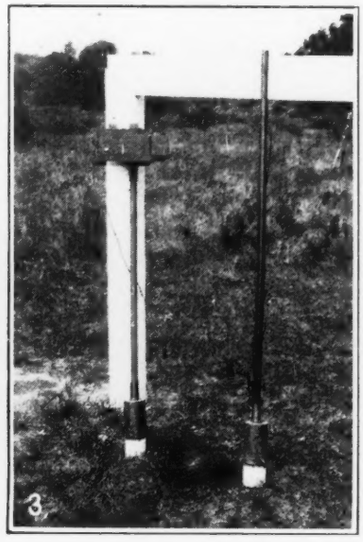


Fig. 1—Eötvös balance in special heat-insulating hut. Fig. 2—Two types of portable magnetometers. Fig. 3—Equipment for self-potential surveys.

IN 1923 a Western mining company was experimenting with the device of an inventor designed to locate buried ores by radio. Because the progress was slow and the results were confusing, the company began to doubt the usefulness of the method and invited me to review the whole question of the application of physics to ore detection. I was fortunate in securing the cooperation of several physicists who had worked with me during the war on the problem of submarine detection. This group has been increased and has been studying the problem of physical exploration for ores since that time.

It was evident that the problem is a big one, with many angles of approach. Its general features may be set down, in rough outline, as follows: The soils, rocks, and ores hidden beneath the surface differ one from another in many respects. These differences may be made to furnish a clew for the physicists working from the surface. To bring these differences into action the physicist creates some kind of an effect which penetrates into the ground and is distorted and reflected when it meets boundaries between different sorts of underground structure. In other words, he sends a message down, and the rocks and ore send back signals in reply. In picturing this process, we should not regard the ground as dense and impenetrable. The kind of messages used pass through the earth about as readily as a sound wave travels the air.

If, then, the fundamental procedure is to shout down questions in the hope that an orebody will hear and answer back to us, it is clear that a large part of the expert's study must relate to the kind of questions best suited to the temperament and intelligence of orebodies. It will be easier for the ore to reply to some of our questions than to others, and it is for us to find the right questions. In certain cases, we are spared the necessity of using a messenger, because nature has already provided one. For example, we already have a terrestrial magnetic field which automatically and continually conveys messages from underneath. We also have available the earth's gravitational field which furnishes us information any time we care to record it. In other cases (which are in point of fact the most important ones) the ore is too polite to talk unless spoken to, and we therefore have to stimulate it with an artificial field. Whether natural or artificial, the utilization of the appropriate kind of exciting field is of the first importance in the process of physical ore detection.

It is equally apparent that we must be able to translate the message which the earth sends back to us in order that it may tell a story. This process of translation or diagnosis will often be complicated, for every part of the underground structure sends back its own answer, and we must separate one from the next and bring order out of a confusing babble of replies. This interpretation of the orebody's message is perhaps the most difficult part of the problem. One must know in what language the ground will speak, how to distinguish the Chinese of the surface soils from the Greek of the ore. It was obvious from the beginning of our work that the interpretation of messages was going to play a major rôle in ore detection, and our experience during the subsequent years has only emphasized this fact.

From the beginning of our work we adopted a policy of emphasis on the fundamentals of the project. We desired to explore all the possible paths which might reasonably be hoped to lead to results of practical significance. This involved a review of the prior work on geophysics, a study of theory and apparatus, and tests

This paper was presented at the joint meeting of the New York Sections of the Mining and Metallurgical Society of America and the American Institute of Mining and Metallurgical Engineers at the Machinery Club, New York, on Oct. 27.

and comparisons in the field and over known orebodies. We attempted to apply the fundamentals of physics in an unbiased investigation of all possible physical means of searching for ores. In the four years which have been devoted to this work important progress on both the theoretical and practical aspects of the problem has been obtained, and as a result the whole situation has become greatly clarified in our minds. I hope I may convey to you our conception of the work of the physicist in exploration, of the possibilities and limitations of his tools, of the manner in which practical success is being achieved, and of the present status of this development.

The acoustic method—which is, broadly speaking, the study of the echoes reflected by orebodies from incident sound waves—early proved rather disappointing. Perhaps the future will bring success with methods which work on a somewhat similar principle (the seismic methods), but the difficulties in such applications are of a serious nature. The seismic and acoustic methods depend upon the distortion, reflection, or change in velocity of an artificially produced small earthquake wave, or of a sound wave. In the neighborhood of most orebodies the rock conditions are complicated by fracture zones, by faults or folds, and, in general, by many irregularities. Such conditions will usually produce greater distortions in a seismic wave than the ore itself. In districts such as the oil fields of Texas, where the structure is simple, seismic methods have been successful in the discovery of oil domes, but extensions of these methods to ores have not yet been of practical significance.

Another physical method is the gravitational one, which makes use of the earth's natural gravitational field. Each cubic foot of rock, ore, or soil exerts a gravitational pull which is proportional to its weight, but which rapidly decreases as the distance from the observer becomes greater. Distances being equal, the heavy ores exert a stronger attraction. The instrument which is now most widely used in gravitational measurements is the torsion balance of Baron Eötvös. The instrument is called a "balance" for the following reason: It is so constructed that it gives no response when the subsoil beneath it is uniform in density or where successive horizontal layers are uniform. If there is an excess or deficiency of density on one side or the other, the instrument becomes unbalanced and gives a reading. The Eötvös balance is of such extremely high sensitivity that it is necessary to set it up over ground which has previously been smoothed for a radius of about 6 ft. Moreover, a topographic survey of the neighborhood must be made and the effect of near-by surface irregularities computed and corrections made therefor. The balance is relatively expensive and slow in application,

Fig. 4—Hand-driven electric alternator for self-potential method

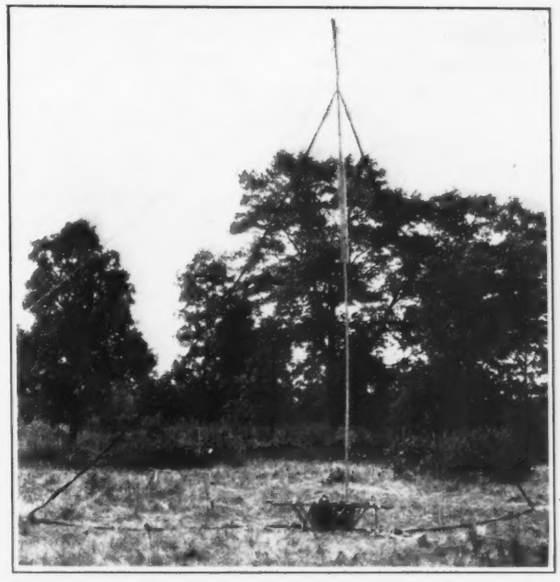


Fig. 5—Sending equipment used in inductive method. Note the triangular loop

for one can obtain observations at only four stations per 24-hour day. Its usefulness is, therefore, greatly restricted and is confined chiefly to the confirmation and extension of the results of other methods, or for special purposes where relatively simple large-scale structures are of interest. It will thus be clear to you that the success of the Eötvös balance in such districts as the oil fields of Texas cannot be duplicated in most mining regions. We have made tests with the balance in two mining districts and believe that it has useful, though quite restricted, applications in ore work.

In common with the gravitational method, the magnetic method is concerned with the reception and interpretation of messages which nature automatically supplies. It is the oldest and most familiar application of physics to mining exploration, but in recent years it has become of greater importance than ever before. The pocket dip needle of the geologist has found increasing application in the rapid and cheap survey of areas showing pronounced magnetic characteristics. Where the magnetic variations in the earth's field are small and where increased accuracy and sensitivity are desired, field instruments are now available which far surpass, in reliability, speed, and accuracy, those of a dozen years ago. The discovery and interpretation of concealed intrusives, faults, and structures in general, by magnetic methods, as well as the delineation of magnetic orebodies, have all undergone pronounced improvement as a result of the present increased interest in geophysics. In many cases, magnetic methods offer a more powerful tool than any any other in the exploration of hidden geological structures.

Besides the magnetic methods, the electrical methods alone are suited to reconnaissance exploration for metallic minerals, and I assume that you are chiefly interested in these methods. The electrical method which I shall first describe is similar to the magnetic and the gravitational methods, in that no artificial source is required to provoke a response from the ore. This is the self-potential method about which Mr. Kelly spoke to your society last May. Mr. Kelly explained, you will recall, that orebodies, particularly sulphides, undergo oxidation and that the upper zones are usually in a state of activity

different from that of the lower ones. The difference in chemical activity leads to a current flow tending to neutralize the difference of potential. This current spreads through the ground for considerable distances, but it is all supposed to pass through the orebody, just as all the current from an ordinary dry cell passes through the cell, regardless of the complications of the external circuit. In fact, the dry cell is the best simple analogy to an orebody supplying current in the manner

Fig. 6—Receiving equipment used in the inductive method

mentioned by Mr. Kelly. By tracing the current it should be an easy matter to find the ore. The apparatus used in tracing the current flow is called the self-potential apparatus, because it measures the potentials naturally associated with the current flow.

The best early work with the self-potential method was done by Carl Barus in 1882 at the Comstock Lode. He applied the method almost in its present form. About 1913 Prof. C. Schlumberger, of Paris, revived interest in self-potential work and began a series of careful and extensive experiments in its theory and application, which contributed much to the knowledge of this method.

Other Electrical Methods

All other electrical methods require an artificial exciting means in order to elicit a response from ores. Such methods may be divided into two main types, the surface potential and the inductive.

The exciting means in the surface-potential method is the flow of electric current through the soil. A dynamo may be used as the source; current from it is led into the earth at one point, and out at another, by means of grounded metal stakes called electrodes. The underground current flow follows the lines of least resistance, and tends to concentrate along any conductors, such as orebodies which may be in the neighborhood. The occurrence of underground concentrations is indicated by the nature of the current distribution at the surface.

Professor Schlumberger made creditable contributions to the study of artificial current distribution at the surface as influenced by ores. Hans Lundberg and his associates were also active pioneers in the development of this method, and introduced the use of straight extended electrodes, grounded at intervals along their length, instead of point electrodes. The current was thereby introduced into the ground evenly along the length of the electrode. The two electrodes roughly bounded the region of exploration, and were often very long, say 3,000 ft., and separated nearly as far, say 2,500 ft. The current paths at the surface between the long parallel electrodes are, in the absence of disturbing factors, straight and parallel; hence their distortions are readily apparent. Mr. Lundberg's extended electrode system has received wide application and has created much interest in electrical prospecting.

The Inductive Method

The other, or inductive type of electrical method, includes most of those special methods now in use. In this method an alternating magnetic field is created, which is similar to the natural magnetic field of the earth, except for the fact that it reverses periodically at a high frequency. This frequency is usually of the order of 1,000 cycles per second, or in the acoustic range, but it may be higher—as high as a radio frequency. The magnetic field penetrates the rocks and soils of the earth nearly as readily as it does the air above. However, when it encounters a conductor, let us say an orebody, a new magnetic field of the same frequency and general characteristics is emitted by the conductor. This new field radiates from the conductor in all directions in the same general manner as did the original one from the original source. It is called the secondary, or induced magnetic, field, and we therefore refer to this general method as the inductive method of electrical prospecting. The secondary field which is created through the presence of the ore constitutes its answer to our question, and is of course the one we wish to measure and study. At any point, however, both the primary and secondary fields are necessarily co-existent, and all we can do is to measure the total and then estimate what amount is due to the ore.

H. R. Conklin and others deserve credit, both for the early recognition of the possibilities of this method and for contributions toward its practical development.

Advantages of the Inductive Method

The inductive method has the following basic advantages over the other electrical methods:

1. It requires no grounded electrodes. Good electrical contact with the ground is difficult in rocky and barren regions, on ice-covered lakes and in deep snow, and in dry sand and gravel. The application of the inductive method is independent of such surface conditions.

2. A related advantage is important. With the surface-potential method, current flow must, of course, reach the ore, and be concentrated in it, in order to produce the desired distortion at the surface. If highly insulating layers exist below relatively conducting surface soils, nearly all the flow will be shut off from the deeper regions and be confined to the conducting surface soils. The ore will get no chance to indicate its presence. A similar situation may occur in the use of the self-potential method, for obviously the normal field of current flow as generated by the oxidization of the ore will be much modified by an intervening insulator. However, in the inductive method, the magnetic field penetrates an insulating layer nearly as readily as air and, therefore, the intervention of an insulating region is unimportant.

3. Both the surface potential and inductive methods depend primarily on the conductivity of the ore. This dependence is, however, of a fundamentally different type in the two cases. In the case of the surface-potential method it may be said that no absolute scale for the measurement of conductivity exists. To illustrate, let us assume a definite topography with the two grounded electrodes in position. Now, imagine the conductivity of every portion of the subsoil multiplied by the same factor, say one thousand. The current paths will remain unaltered by such treatment.[1] In other words, the current distribution is determined by the *ratio* of the conductivities of adjacent regions, not by the absolute values. Moreover, the influence of this ratio upon the distribution undergoes a saturation effect, in that higher values of the ratio produce only slightly greater concentrations. When the conductivity ratio exceeds 10 or 20, about 90 per cent of the possible influence is realized, and higher values are of no appreciable avail in strengthening the indications caused by the conductor.

In practice, it is unfortunately true that ratios of conductivity of 10 or more are obtained between neighboring soils. The chief cause of such difference is moisture content; which in turn depends upon type of soil and upon topography. These differences, then, are about as effective in their influence upon the surface potential method as a difference of 10,000-fold between ore and soil. In the inductive method this difficulty is absent, for, in surface covers of high electrical resistance, the terrain response depends nearly directly upon the *absolute* conductivities and not upon the ratio of adjoining portions. Therefore, regardless of the value of the ratio, the entire response will be small whenever the conductivities are slight. Fortunately, the conductivity of cover is usually small, and thus the influence of topography is much less pronounced. The inductive method is thus better able to distinguish between the enormous conductivity differences between ores and cover and the far lesser variations occurring in barren land.

Of the six methods which I have outlined, we have been studying and using all except the seismic. Although our major interest has been in the development of the inductive method, we have found practical value in all the others. In most of our surveys we use the self-potential, magnetic, and inductive methods in combination with one another. The gravitational and surface-potential methods are reserved for special conditions, and as special checks.

I think you will now be interested in seeing pictures of applications of the methods I have described.

Fig. 1 shows the Eötvös gravitational balance in its special heat-insulating hut. This equipment, as I have said, is limited in speed to about four stations per 24-hour day.

Fig. 2 shows two types of portable magnetometers for the measurement of the terrestrial magnetic field. One is the Askanie balance, the other the Gepege. The Askanie balances are very satisfactory. They are reliable and rapid in use, and we often average 80 observations per day with them.

Fig. 3 shows equipment for self-potential surveys. The two electrodes are porous cups, filled with copper sulphate solution. The potential difference existing between the two electrodes which are placed on the ground is measured by a potentiometer, which is mounted above the left-hand electrode. You will observe how simple and portable is this equipment.

Fig. 4 shows a hand-driven electric alternator for supplying current to the ground for the surface-potential method.

Fig. 5 relates to the inductive method, which is our primary one in reconnaissance work. The photograph shows the power source (at center), which is a light gas engine set, and the triangular sending loop. The entire equipment is readily portable by two men.

Fig. 6 shows the receiving equipment used in the inductive method. It consists of the rotatable coil mounted and leveled on the tripod, the amplifier in the box and the head phones. The direction of the magnetic field is measured with this equipment. For the measurement of intensity a more elaborate form of apparatus is required.

I do not wish to confuse the situation by illustrating equipment which is either in the experimental stage or suited only for specialized purposes. The equipment for the methods which I have mentioned is not cumbersome and complicated. It is of strongly constructed type, and capable of rapid use under most field conditions.

I shall now touch upon our customary type of survey, employing the magnetic, self-potential, and inductive methods. These particular three methods are chosen, when conditions are suitable, because they are rapid and relatively economical, and because they are entirely independent of one another in the physical properties upon which they depend.

In the first place, it will do no harm to recall that the geologist must select and limit the area desirable for electrical exploration. The work thus begins with geology. Furthermore, it needs geology during its course in the field. Lastly, after the data are all taken, the important work of interpretation of results and of forming a logical and self-consistent picture requires all the aid geology can give. The conclusions must fit the known geological, as well as physical, facts.

In some cases the mining companies supply all the necessary geological assistance. Often, however, it will be expedient for geologists associated with physical exploration groups to assume this responsibility. Such a course has the advantage of putting the whole exploration problem into the hands of one group, experienced in all phases of the work, and accustomed to studying together the various kinds of problems which arise. I think the advantages of such co-operation need no recommendation. Prof. Warren Meade, of the University of Wisconsin, is directing the geological phases of our work.

The area chosen for survey is laid out in long straight parallel traverses separated in conformity with the size of possible orebodies, such that at least one traverse will, in all probability, pass above any body large enough for commercial importance. Often a spacing of 500 ft. is suitable; sometimes it is much less. The observations are made at 100-ft. intervals along the traverse, and at each station readings with the three independent methods are usually taken—the inductive method, the self-potential method, and the terrestrial magnetic method. Our usual physical exploration thus involves brush-cutting, the transit survey of the traverses, and the chaining of the observing stations, together with the operation of the inductive method by two observers; of a magnetic balance by one observer, and of the self-potential apparatus by one observer and a helper. In all, excluding axemen, such a survey will require a personnel of five engineers and two assistants.

[1]This is not rigorously true, but holds for the conductivities and frequencies customarily used in practical ore detection work.

We have attempted to improve the speed and efficiency of exploration in the use of these three methods. In some hundred miles of traverses in the Sudbury nickel basin, near Sudbury, Ont., we have averaged 72 acres of reconnaissance work per day, with each of the three methods. The work was done in a period of about four months, and this average of 72 acres per day is the gross daily average for some 7,000 acres, including time lost because of weather conditions and other unfavorable circumstances. At times 20,000 ft. of traverse have been done per field day with the inductive method, and this through heavily covered and rough country. This corresponds to about 250 acres per day. The methods may therefore be applied with speed.

The Physicist's Work

I have outlined the basic problem of physical exploration and described to you methods by which practical work may be carried out. A critical valuation and understanding of the real nature of these methods can be obtained only through the scientific studies to which they owe their birth and development. I should now like to view these scientific studies through the physicist's eyes, and to show you the means by which practical methods are evolved and by which progress in the basic problems of physical exploration is being attained.

In outline, we have seen that the physicist's problems are of two kinds—those of excitation and those of reception and interpretation. We are not here concerned about the details of apparatus for producing or receiving a field. The real limitations of ore detection lie in indications of suitable strength as compared with other disturbances similar in kind. We therefore ask: Granting perfect apparatus, what can physics do, and what can't it do, in detecting ores as they really occur?

There are three basic ways by which physics gathers information about the detectability of ores: (1) The mathematical method; (2) the laboratory and experimental method; (3) the knowledge gained from widespread practical field experience. Each is of prime importance.

Mathematics Applied to Detecting Ores

The first of these methods, the mathematical, tells us exactly what occurs when the source field which we create meets a postulated orebody, or other change in structure. This would appear to be all we want to know, but unfortunately there are difficulties. We find the mathematician cannot supply solutions except for a few simple cases. When we ask for the answer, he says he cannot give it, but can supply something nearly as good. He then changes our actual problem around so that he will be able to solve it. A lump of massive ore becomes to him a smooth sphere, the irregular cover becomes homogeneous, the hills and valleys are smoothed to a level surface. Or if the ore seems to occur as a sheet, it takes the form of an extended plane. Other shapes of bodies are approximated by various kinds of ellipsoids. The geometry must always be simplified.

Although the solutions available pertain only to such idealized cases, much useful information results from them. For they at least show us the best that may be hoped for under simple conditions, and how strong and of what character the message sent to us by certain simple orebody shapes will be. Moreover, we may approximate the answers for more complicated problems by a judicious combination and manipulation of the results for the simple cases.

In dealing with these idealized problems in ore detection, the physicist becomes impressed with the fact that his solutions pertain to more general problems than the particular one with which he started. There is, in fact, an interesting similarity between the gravitational problems, the terrestrial magnetic ones, the direct current ones, and electromagnetic or inductive ones. I have no doubt the same similarity can also be discovered in certain seismic applications. Thus the physicist is led to value a broad point of view in approaching the subject. It may be said, indeed, that the basic study in geophysics is the propagation and distortion of physical fields, whether they be gravitational, magnetic, or electromagnetic. To make my meaning clearer, let us consider the detection of a sphere by the various methods. We arrive at the following results: A magnetic sphere in the earth's magnetic field, a conducting sphere in the field of flow of a direct electric current, or a conducting sphere under the inductive influence of a magnetic field, all give the same kind of mathematical solutions. The gravitational effect of a heavy sphere on the Eötvös balance is, moreover, closely related to the effects in the three cases.

Unfortunately, the inductive method of exploration, which we consider the most valuable one, is also the most difficult of mathematical analysis. The physicist at present has to make greater simplifications than he wishes, in order to get problems he can solve. However, he uses these answers, when obtained, chiefly as a guide book to show the general characteristics of the case, and employs additional aids, as we shall see, which make the situation better than it may appear.

I have said that the mathematician can predict the response of certain simple types of ore deposits to the fields we choose to impress upon them; and that these solutions may often be extended to tell us approximately what will happen under more complex conditions. I must now, unfortunately, mention a difference between such problems and the real ones of a survey. For we have been putting the question thus: Granted a buried sphere, or other deposit, can its response be predicted? Answer, "Yes." But we should have put the question other end to: Granted the field party turns in an observed response, can we determine exactly what caused the observed data? Answer, "No," strictly speaking, for we cannot solve the problem backward and so find the cause of the results. It is fundamental in electrodynamics that, to find out what is inside a region, one has to get measurements all around the boundary surfaces. Of course, the ground surface alone is accessible in electrical surveys. We cannot measure the fields below and at the sides of the ore.

How the Physicist Proceeds

In practice, the physicist is forced to proceed as follows: He obtains, digests, and catalogs as many of the mathematical solutions of idealized cases as possible, being careful to check these solutions by appropriate experiments. Then he tried to fit the observed field data to the typical results in his file records, and draws approximate conclusions as to the shape and position of the ore. If he is led to believe the indications are caused by several different and separate conductors, he has to consider them separately by a process of subtraction.

In simple conditions his predictions will be closely correct, but it is always necessary to make some assumptions or guesses in the process of interpretation. Of course, geological knowledge, experience, and common sense are at the bottom of such guesses. For example,

the field data may indicate a deposit roughly spherical in shape. Then, if the physicist assumes that the topographical effects are either known or negligible, that the cover is uniform and disturbing factors are absent, he may accurately locate the center of the sphere from theory. It would also be useful to know how large a sphere had been discovered. Unfortunately, this question cannot be accurately answered. Before the physicist can do so he has to decide what the conductivity is, for radius and conductivity jointly determine the magnitude of the response.[2] One might hope that this difficulty would be clarified by the use of different frequencies for the impressed field, but unfortunately this will not help.

In brief the situation is this: The form of the response field at the surface will tell us that the source of the disturbance is a sphere, and also tell where its center is. Determination of the radius and conductivity is not unique, and estimates are therefore without logical basis. Although rigorous analysis is without avail, we may guess a reasonable value for the conductivity, and thereby obtain an estimate of the radius.

My purpose in spending so much time on this simple problem of the sphere is to show you that, even when conditions are exceedingly simple, there are difficulties in telling *all* about the case. You can imagine how much more complicated interpretations must become when several bodies are present or when shapes are irregular and structure is complicated. Some operators of electrical exploration methods offer to do things for us which are entirely outside the bounds of known science. They are the spiritualists of geophysics, and obtain messages which no others can decipher. The honest and informed physicist must admit the limitations of his science.

Under shallow cover, we may expect reasonably close delineation of the position of ores, but it will always be difficult to distinguish between the conductivity of the substance and the total amount present. Naturally these enter together, and it is hard to separate them. As the depth of cover increases, the determination of ore boundaries becomes more and more uncertain.

(To be concluded)

[2]It is theoretically possible to determine the conductivity and radius separately, but, practically speaking, sufficient accuracy and certainty are not yet attained.

Europe Making Economic Recovery

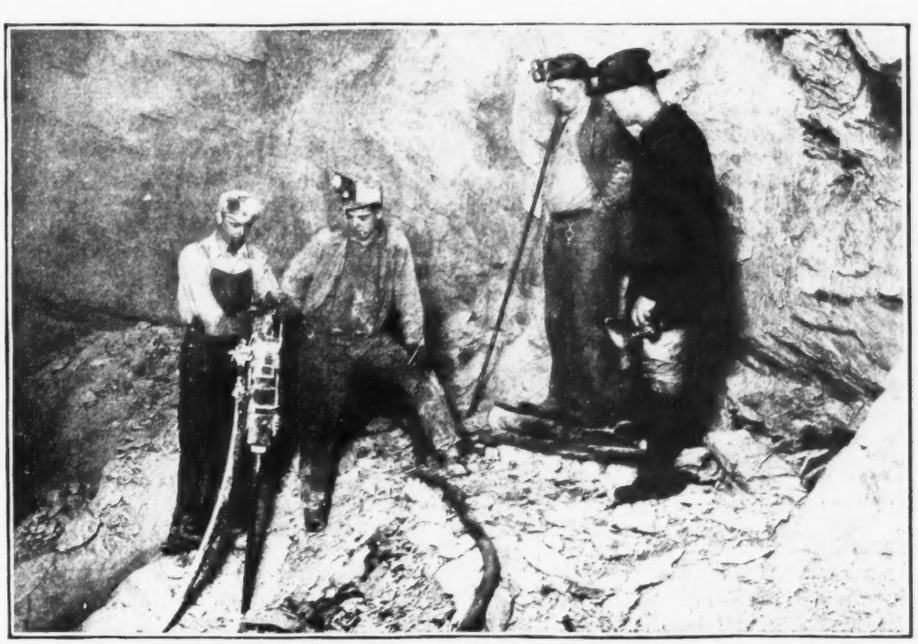
EUROPE has made definite progress toward economic recovery during the last few months, says Basil Miles, American administrator at the headquarters of the International Chamber of Commerce, in a report just made public by the American Section of the Chamber. Though many difficulties yet remain, he says, they are being recognized, improved, and overcome from day to day.

"Individual countries," Mr. Miles says, "are progressing steadily to an extent which has already changed the face of Europe and, by that very fact, have bettered conditions elsewhere beyond its confines. Those who have observed France are clear in their minds that the capable performance of M. Poincaré's administration is reaping its logical harvest. Prices are still out of harmony, but confidence and stability have wrought their inevitable benefits. The pressure of political considerations alone, in the form of the general elections impending next spring, retards the placing of the capping stone on the financial recovery of the country in the shape of a definite stabilization of the currency.

"Critics who are skeptical about Germany seem to ignore the incontrovertible facts of the rise from chaos to stability in three years. Critics of Italy seem impressed rather by the price paid than by the amazing benefits—not only material but spiritual—which Italians have received for the sacrifices their present regime has required.

"The political torpedo held in leash in the Balkans seems more and more subject to the economic influences which are so increasingly a guiding factor in more populous and more powerful states. The rehabilitation of Austria, despite the physical difficulties involved in the facts of that country's curtailed resources, both physical and social, seems to progress. Hungary has proved that its future problems are, in the main, political rather than economic.

"The situation today is so much brighter than two years ago that many have forgotten the possibility of comparison. Perhaps the darkest cloud in Europe is that which hovers over the delayed solution of the relations between capital and labor."



Drilling a bench in a large open stope

The Auriferous Alluvials of Colombia

By Mariano Ospina Perez

Civil and Mining Engineer. Manager, Compañia Minera de Colombia, Medellin, Colombia

MARIANO O. PÉREZ

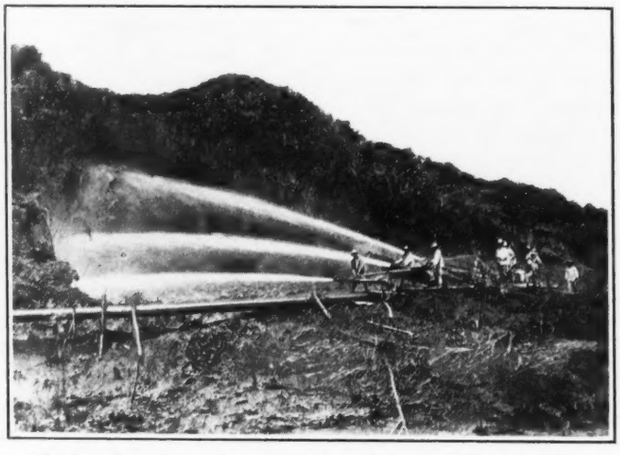
IT is doubtful if any country today offers greater opportunity for the exploration of gold alluvials than Colombia, South America. Numerous auriferous deposits are found in the Department of Antioquia and the Province of Choco, and in a lesser degree in the departments of Tolima, Bolivar, Caldos, and Cauca. The section of the country represented by these political divisions is mountainous but is traversed by numerous streams. Its rugged topography results in many waterfalls in the rivers, which make suitable sites for hydro-electric installations. The section is fairly well populated, affording an adequate supply of cheap native labor.

Since the sixteenth century natives and Spaniards have worked the surfaces of the reefs and alluvial beds of the small streams, using primitive and rudimentary methods. The value of the production from these operations for the entire country during the last four centuries has been estimated to have been as follows: Sixteenth century, $53,000,000; seventeenth century, $173,000,000; eighteenth century, $209,000,000; nineteenth century, $315,000,000; a total of $750,000,000. Approximately $319,500,000 of the total represents the value of gold recovered in the department of Antioquia. This department today is in mineral resources the richest department of the country; it produced $5,000,000 in gold during 1921, and the annual valuation of the department's gold production for the last five years has been about the same figure.

The Clara mine on the Porce River

The first hydraulic monitor brought to South America was installed in 1870 at the Malpaso mine, in the Department of Tolima. In 1880 a company was formed in the United States to dredge along the Atrato River, but misfortune befell the enterprise, the first dredge sinking in the river and the second being severely damaged soon after starting operations.

The use of hydraulic elevators dates back about twenty years when the first elevator was used in the Porce River. During the last ten years fifteen companies have placed elevators in this river, with good results.



Hydraulic giants in operation along the Porce River

At the Hormiguero mine, on the Porce River, a 12-in. elevator recently produced 3,200 oz. of gold in two months. Similar elevators in the vicinity have recovered 800 oz. of gold per month at a total cost not exceeding $2,500. A few plants are now in the course of erection along other rivers of the Department of Antioquia. However, most of the installations are on the Porce River, because of the transport facilities in that section and labor available at the near-by town of Medellin.

Several dredges are being successfully operated in the country, but it is evident that the most promising gold fields today are those where monitor and hydraulic elevators can be used. First cost and operating expenses are less for this equipment than for a dredge, and, also, it is better adapted to the working of the richer alluvial deposits in the upper courses of the streams. The Antioquia and Choco regions offer exceptional opportunities for monitor and hydraulic elevator operations.

In conclusion I wish to express the belief, which is based on a thorough study of the alluvial deposits of Colombia, that the rivers of the Department of Antioquia and of the Province of Choco today offer ample room for the profitable operation of more than 200 monitor and hydraulic elevator installations.

An Example of Modern Practice in the Recovery of Tin From Tailing

By E. G. Lawford

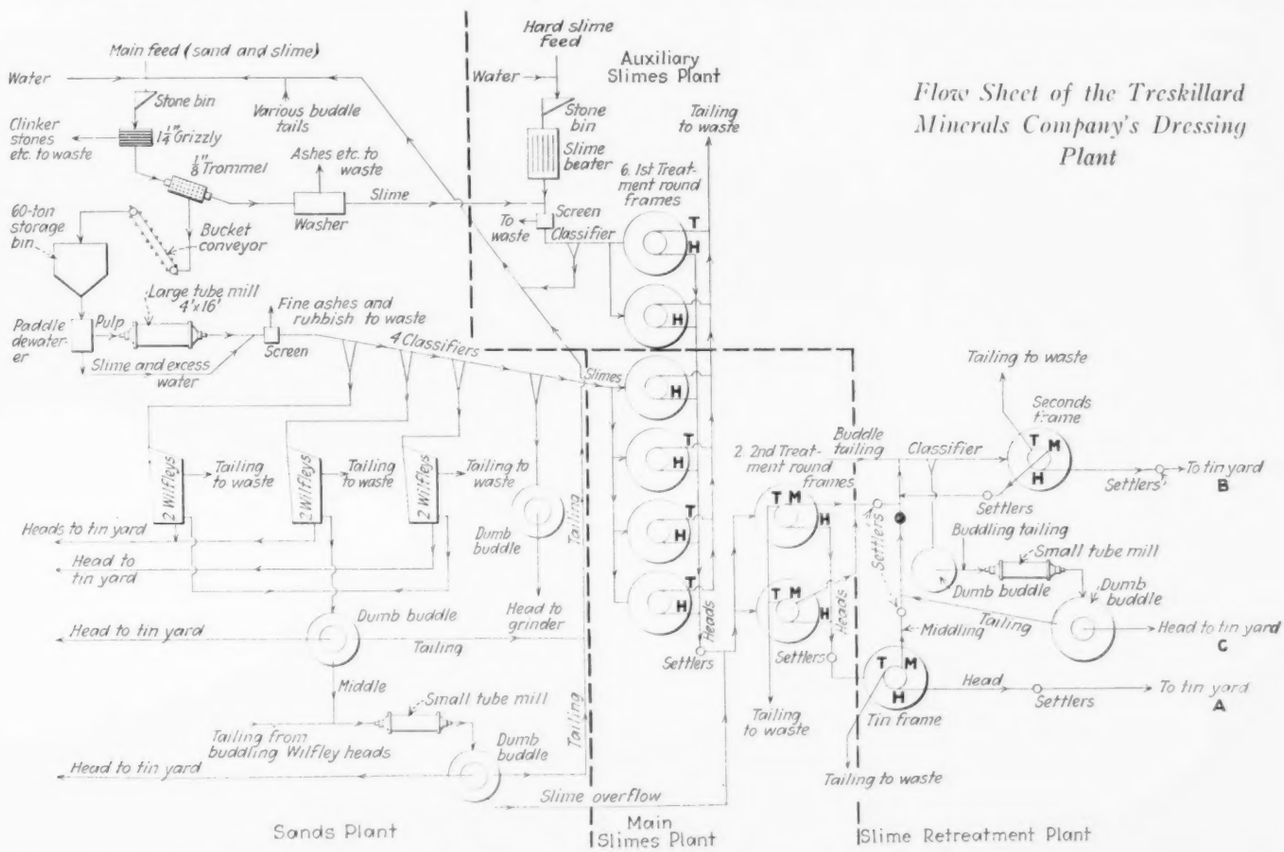
Mining Engineer, Rio Tinto, Spain

THE large tonnage of tailing stacked by the old Grenville, West Frances, South Frances, and West Basset mines, in Cornwall, is now being profitably treated by Treskillard Minerals, Ltd. A recovery of about 75 per cent is obtained, or over 9 lb. of tin concentrate (54 per cent metal) per long ton of material treated.

From 50 to 60 long tons of mixed sand and slime per day is handled by the plant, which although it possesses no novel tin-concentrating appliances, has certain features in the method of operation, and in the tin-yard practice, that are mainly responsible for the success achieved. The operators have realized that the apparently crude appliances used for the concentration of tin ores are susceptible of fine adjustment and delicate work. They are aware that to obtain efficient concentration and minimum loss of metal, products of varying degrees of grade and of coarseness must be treated separately; and that all products that are alike in grade and size of particle, irrespective of origin, must be treated together. This avoids an excessive number of products. The operators, therefore, lay stress on the importance of classification; they believe that, in general, a machine that is delicately adjusted for one class of product will not treat any other class efficiently.

The principle of thorough classification begins to operate immediately after the primary grinding. The tube-mill discharge, before passing to the Wilfley tables of the sand plant, goes through a series of classifiers, and each pair of tables treats only material supplied by its own classifier. These tables make a head which goes for final treatment to the tin yard, where the heads from each pair of tables are buddled separately. Before being reground, the Wilfley middlings are buddled. This buddling yields a small amount of high-grade head and a small tailing, suitable for return to the primary grinding circuit.

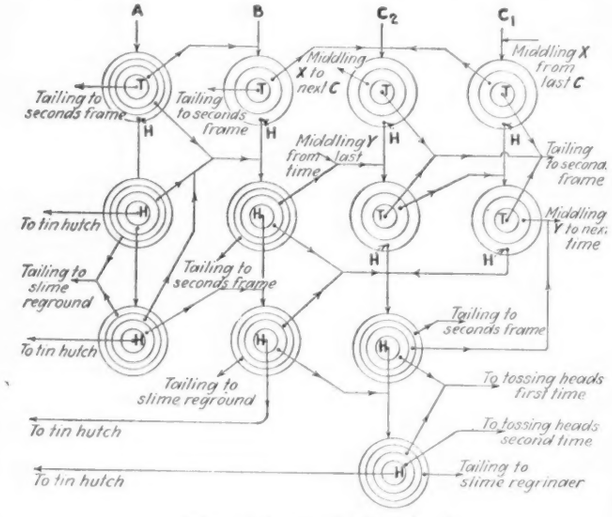
It will be seen, therefore, that the buddle has two functions: it classifies and it concentrates. In its capacity of classifier it yields a more uniform middle product,



Flow Sheet of the Treskillard Minerals Company's Dressing Plant

and the load on the secondary tube mill is diminished, the tailing being sufficiently coarse to warrant its return to the primary grinding circuit.

The product of the regrinding tube mill is treated on a second buddle, which yields three products—a head for tin-yard treatment, a tailing for return to the primary tube mill, and a slime overflow for treatment in the slime plant. The slime plant is divided into three sections. The first section consists of six round frames, two of which are reserved for the treatment of slime material coming



Flow Sheet of Tin Yard

direct from the dumps and needing no grinding, the remaining four treating the slime overflow of the Wilfley-table classifiers. All these frames reject a worthless tailing, the head product passing to the second section of the slime plant; this section consists of two round frames which make a head, a middling, and a waste tailing. The heads, being of uniform size, are passed directly to a round frame known as the "tin frame," which produces a head for tin-yard treatment. The middling product is passed to a frame, known as the "seconds frame," but before framing it is classified, the spigot product being reground and buddled, thus making a head for the tin yard. This "seconds frame," with its classifier, also treats slime-buddle tailing from the tin yard and the middling product from the tin frames.

The final or tin-yard treatment consists of buddling, tossing, and packing in kieves. The buddle feeds are arranged so that only one class of material is treated in any one buddle at any one time. That is, all products different in size or grade are buddled separately; it is only when two or more products are similar in both grade and size that they are mixed and buddled together. Particularly at this point, considerable skilled direct supervision is necessary.

The general principle governing the tin-yard practice is that, if any given head requires, say, one more buddling to make a final concentrate, the first middling will require two more, and the second middling three more buddlings to make final concentrate. The first middling, therefore, is mixed with another product of similar size requiring two more buddle treatments and the second middling with a product requiring three more.

For example: "A" is a product that requires to be buddled twice, and "B" is a product that requires to be buddled three times before a final concentrate is obtained, both "A" and "B" being of similar size (say, both slime). "A" is buddled once; then, to make a final concentrate, the first middling requires two more buddlings, and the second middling requires three more buddlings. The second middling would go with "B" the first time, because both products require three more buddlings, and the first middling would go with "B" the second time for two further buddlings, to make final concentrate.

The average price realized for concentrate sold during the year ended March 31, 1927, was £130 per long ton (after deducting returning charges). With an extraction of 9 lb. of concentrate per long ton of ore treated, this means less than 10s. 6d. per long ton treated. Thus, to make a profit, working costs must be kept low. The following are the approximate costs per ton of concentrate produced:

Haulage from dumps to plant	£ 10
Labor and supervision	36
Power	30
Repairs, office and other expenses	9
Total in Cornwall	£ 85
Head office, royalties, rates, depreciation and general expenses	15
Total	£ 100

The table shows that the total expense is about 8s. per long ton of ore treated.

The successful conduct of a dressing plant of this type is obviously dependent to a considerable degree on the personal element—on highly skilled and close supervision. Any one machine running out of adjustment for an hour or so entails not only direct loss of tin but dislocation in subsequent stages of the process.

It is open to question if it would be possible economically to run such a tailing plant with a daily capacity of 400 tons instead of 60. Whatever the answer may be, the designers and operators of the Treskillard Minerals plant have demonstrated that tin dressing is still susceptible of further improvements in respect to over-all recoveries, and it is to be hoped that some time in the future they will publish a detailed description of their methods of controlling operations, written from the point of view of the tin dresser—something more than the outline given in the foregoing notes.

I am indebted to Mr. Myles Canning, of the Treskillard Minerals Co., for the information on which the foregoing article is based and for the flow sheet which accompanies it.

Mumetal Increases Speed of Cabling

ACCORDING to H. C. H. Carpenter (James Forrest Lecture delivered before the Institute of Civil Engineers), the first commercial application of electric melting by means of high-frequency current in Europe was made by a British firm for the preparation of nickel-iron alloys for submarine cables. The research work carried out, in order to find a suitable alloy, was thereby much facilitated, and quickly resulted in the perfection of the series of alloys known under the name of "mumetal" (so called because the Greek letter μ is used as the symbol of magnetic permeability). These alloys have highly desirable characteristics, and by their use the speed of cabling can be increased seven- to eight-fold.

A typical mumetal alloy has the following composition: Nickel, 74.0 per cent; iron, 20.0 per cent; copper, 5.3 per cent; manganese, 0.7 per cent. An alloy of this composition has a magnetic permeability of 7,000. Low hysteresis loss with a very high permeability at low magnetizing forces are the characteristics chiefly required in these metals.

How Far Can Mining and Quarrying Be Mechanized?

By George J. Young
Associate Editor

THE miner has ever been thrifty of manual effort and ready to adopt mechanical means when proved suitable for underground conditions. His readiness to use machinery in surface work is even more demonstrable, as the steam-shovel operations of the Lake Superior iron country and of various copper camps bear witness. The question may be asked, has he really done away with hand labor to the extent that is possible by the use of up-to-date equipment. If not, what can still be done? What chance remains for further mechanization in the mining industries? This question can be answered only by a survey of present practice.

Space Limitations an Important Factor Underground

Underground conditions are curiously limitative in several directions. First, most underground workings are of restricted dimensions. Shafts and adits are of limited cross-section, and this fact must be taken into consideration in the design of machinery to be placed underground. Examples of massive underground equipment include pump stations, but almost all large units are erected piecemeal, no part being of greater size than can be handled in a 4½ by 5-ft., a 5 by 5-ft., or a 5 by 6-ft. shaft compartment. Likewise, the dimensions of adits, drifts, and crosscuts control the size of individual machine parts. Weight is another factor, for if the capacity of hoisting cables and accessory equipment is exceeded, special rigging is necessary for handling and lowering.

Machinery for underground use must be of simple, of strong construction, and as near foolproof as possible. Generally it must be operated by miners or miner mechanics, and although it is desirable to man machines by skilled operators, it is not always practicable to secure and keep such men. Thus an additional employment problem arises if skilled operators are required. This in itself is an objectionable feature of any underground machine. Especially is this so in smaller mines, though not so apparent in larger properties, where a higher degree of specialization in labor can be maintained.

Complicated machines have no place underground unless so well designed and thoroughly developed by experience that operation is relatively easy. Of two machines, one of complicated and the other of simplified construction, the miner will select the latter, although both may be equally serviceable.

Ability to respond to continuous service under normal and at times abnormal conditions is another important requirement. It is not easy to make repairs underground, and any machine that requires considerable attention on the part of repair mechanics will never be popular. As in other mechanical installations, maintenance of operating efficiency should be easy, and parts that wear should be quickly replaceable.

Underground Work Calls for Continuous Service

Service by machines underground should be continuous when and where necessary. To provide continuity of service, duplicates can be installed. In the case of pumps this is usually the practice. Likewise, reserve rock drills are carried so that drilling need not be seriously delayed in the event of the failure of several drills. The necessity of providing machines in duplicate cannot be wholly avoided, but design and manufacture should be directed toward building into the machine those characteristics that will insure a high degree of dependability and quick repair.

Reasonable mechanical efficiency is expected of the manufactured product and is essential for economy. High efficiencies are desirable; but if it be necessary to sacrifice strong construction, dependability, and ease of operation, nothing is gained. An instance is the compressed-air rock drill, which operates at relatively low power efficiency, but which possesses so many other desirable qualifications that the question of power efficiency is unimportant.

Weight of the machine is important in some instances. If it is to be moved about and shifted frequently to new positions, its weight and portability must be considered. Low weight and strong construction present anomalous characteristics, and sometimes strong construction has to be sacrificed to keep down weight, or higher costs are made necessary by the use of stronger metals. The rock drill is an example of the progressive reduction of weight as a result of improved design and the use of superior metals in construction.

Selection of Equipment Is Influenced by Kind of Power Available

The most widely available power agent underground is compressed air. As this is used primarily for the operation of rock drills, the pipe system extends through the active areas of a mine and in close proximity to the working faces. Air pressures from 90 to 100 lb. are customary; and available air pressures near the ends of the pipe system—if this system has been carefully designed, installed, and kept in repair—are close to receiver pressures. Underground receivers are frequently placed at intermediate positions on long pipe runs, and so serve to maintain the working pressures at the drills. Compressed air is not an efficient power agent, but possesses so many other advantages that in spite of its low efficiency it will continue to be used generally. Apart from its principal function of supplying power to rock

drills, it can be and is used for the operation of auxiliary hoists, sinking pumps, ventilating fans, power shovels, ore-chute gates, dumpers, and in several instances for the operation of compressed-air locomotives. It is the safest form of power, affords supplementary ventilation, and does not augment the underground fire risk. Probably the only untoward accidents that have attended its use, and this rarely, are receiver explosions which result from carelessness in operation.

Electric power is generally available. Alternating current at 2,000 volts or less is delivered by power cables to underground transformers where it is stepped down to 220 and 440 volts for distribution to supply wires and cables. Where direct current is required for the operation of trolley locomotives or to supply storage batteries, the motor generator is used to convert alternating to direct current close to the points where it is required. This conversion is efficient, and the mechanical appliances are easily installed and operated. Electric power is supplied to motors for the operation of pumps, electric locomotives, ventilating fans, and hoists, as well as for lighting and signaling. Separate circuits are provided for lighting, for signaling, and for telephones.

Water under pressure is also available; but apart from drilling, water supply, and for fighting fires it is seldom used for power purposes. However, under unusual conditions it is available as a power agent for the operation of pumps, hoists, and ventilating fans. It has many advantages, but the fact that most mines require to be drained or are without natural drainage relegates this power agent to an unimportant position.

Steam power at one time was widely used for pumps and sometimes for underground hoists, but has been displaced by the more convenient, more efficient, and safer electric power. Likewise, the internal-combustion engine has found no place underground, chiefly because of the noxious character of the exhaust and the increased fire hazard engendered by the use of hydro-carbon fuels. Mechanical methods of power transmission from the surface to depth are no longer of importance and are not used. Electric power meets the situation much better.

Where Shall the Power Unit Be Placed?

Years ago it was common to find air compressors installed underground and in close proximity to the locality of maximum requirement. Obvious advantages are apparent, such as reduced pipage, lower air losses, and higher pressures. Disadvantages comprise restricted access to the machine, increased fire risk, and increased difficulty of repair and inspection. The practice is now largely discontinued, and air compressors are installed in the mechanical plant at the surface, where they can be more conveniently operated. It is a general principle to reduce the underground mechanical equipment to absolute necessities. Any increase merely adds to the difficulties and hazards of underground operation. It should be noted, nevertheless, that in recent years underground shops for sharpening steel and tools and for repairing drills have come into favor in certain districts.

All permanent power units are offset from traveling- and haulage-ways as a general principle. Pump chambers or stations are placed close to sumps, and shaft compartments and all openings on a given level drain toward sumps or main water drains. Ventilating fans, transformers, motor-generator sets, and hoists are installed in chambers or stations so placed as best to serve their specific purposes. Usually these are excavated and timbered or supported as permanently as conditions justify. All such places are fireproofed, or the fire risk is reduced as far as practicable by providing suitable means for extinguishing fires and to indicate hot bearings where attendants are not constantly present during operation. Electric lighting is provided at all such units. Power leads, control panels, and indicating instruments are provided for all important motor installations.

All Rock Drilling Done by Machines

It is unnecessary to write in detail of rock-drill equipment; but, incidentally, rock drills fall into three distinct classes—drifters, stopers, and pluggers. All are of the hammer type. Occasionally in mining soft minerals auger-type drills are used. In the softer ores, special drills with faster rotation are employed and are in effect auger drills, although employing the principle of the hammer. Each class has its special range—drifters for holes in all directions but preferably for flat or moderately inclined holes; stopers for uppers, and pluggers for down holes. Drifters are mounted drills; stopers carry their mounting and feeding arrangement as an integral part of the drill, and pluggers are hand-held. Stopers are of two kinds—hand rotated and mechanically rotated. Pluggers are mechanically rotated. Almost all drills used underground are operated by compressed air and are of the water type, or can be modified so as to drill wet. Mining practice is definitely committed to wet drilling underground as a health precaution.

Mechanical equipment in stopes, apart from rock drills, is restricted to small portable hoists used for raising timber, steel, and other supplies from the level below, or for lowering them from the level above, or for operating scrapers. Hoists for handling supplies are of small capacity and are operated by compressed air or electricity. Where electric power is used it is necessary to install power conduit in raises and flexible cable leads to the motors. Efficient, dependable machines are on the market.

Scrapers are sometimes used in stopes for moving ore to passes or loading points, and for their operation heavier hoists of the double-drum type are in use. Here, again, individual choice decides between electric-motor and compressed-air operation. In accord with the general principle of maintaining mechanical arrangements in the stopes as simple as possible, compressed air would contribute to this end, but use is nevertheless made of electric power for stope and scraper hoists.

In large stopes, cage hoists are sometimes installed, and these may be operated by compressed-air engines or by electric motors. As in the use of the smaller auxiliary hoists, mining practice favors the compressed-air hoist, as it avoids the necessity of providing another power circuit in addition to the compressed-air lines.

Mechanical Mucking—Can It Be More Widely Practiced?

Attempts to use mechanical loading equipment have been made in large overhand stopes of the horizontal cut-and-fill type, but this has not passed beyond experimentation, and, as far as my information goes, no heavy power shovels are in use under such circumstances. However, in deposits that are flat or of low inclination and minable in a single lift, compressed-air and electric shovels of several different types are in successful use. The broad condition that makes this possible is the single mining horizon. Heavy power shovels can be moved about, and with continuous-tread tractors are sufficiently mobile for the purpose. Likewise, enough vertical en-

largement and space exists between pillars to permit unrestricted operation. In contrast to this, overhand stoping involves a succession of horizons from below upward. Each slice is a new working, and the vertical range from level to level is from 100 to 150 ft. Thus the mechanical equipment in use must be transferred from time to time as the successive slices are mined. Access to the stopes is restricted to manways of relatively small section. All large equipment must be sufficiently sectionalized to admit being dismantled and re-erected at the start and dismantled at the completion of a block between levels. Usually, supporting timbers and cribs have to be erected where the top develops weakness, and this increases the difficulties of the situation for the larger power loaders. On the other hand, scraper rigs can be used where the ore breaks to a size conveniently handled. The position of the smaller loaders of the Hoar and Nordberg types is uncertain, but it is my opinion that under favorable conditions they could be used in large cut-and-fill stopes.

Are Loaders Justified in Cut-and-Fill Stopes?

The economic justification for the use of loaders in cut-and-fill stopes lies in the fact that when hand methods are used ore passes are spaced at from 25- to 30-ft. centers and must necessarily be carried up and maintained during the life of a block. Only a small proportion of the ore passes are in use at one time, but all are needed for the mining. By mechanical loading and transference on a track it is possible to space the ore passes at greater intervals and therefore reduce their number and maintenance cost. The handling of greater tonnages per ore pass would necessitate better construction and more frequent lining. Additional track laying would be necessary over that required with hand operation. However, power-shovel loading would interfere with waste picking, which is necessary in the mining of some ores. It is also obvious that loading points on the levels would be reduced in number. This would concentrate loading at a few places, which in most operations would be an advantage and would effect a saving in development footage.

The problem of the cut-and-fill stope has not been conclusively solved. Power loaders, whether large or small, present probably more disadvantages than advantages. Under the proper conditions they have been used with profit. Objections to the scraper are that ore fines are likely to be lost and that blocky ores are hard to handle with it. It would appear that light portable conveyors would offer greater advantages than scrapers or power loaders, but here again arises the difficulty of weight and handling. The close spacing of ore passes and the muck stick offer the simplest arrangement, and an effective one. Coal miners, on the other hand, are making use of sectional conveyors. The metal miner favors the scraper rig generally and has discarded the shaking pan conveyor.

The Power Loader in Development Workings

Power loaders for mucking dead ends such as crosscuts, drifts, and adits have passed through an interesting history. Loading machines such as the Shuveloder, Hoar, and other small machines have been tried out in numerous instances, and it appears that for mine development of small cross-section little advantage arises from their use; but where the cross-section is large, as in some adits, development workings and tunnels, power loaders have earned general recognition.

Efforts to obtain a lighter rig resulted in the development of the scraper loader with its accessory loading pan and finally the self-contained rig mounted on trucks. This is a practicable arrangement, as is also its predecessor. The critical limitations in using all loading devices in development workings of restricted cross-section—and these are common in Western metal mines—are quantity of muck to be handled at one time and the number (to a given loader rig) of accessible points where the loader can be used. A 5 by 7 drift yields about 300 cu.ft. of muck for a round of 5 ft. This is about 15 cars of 20 cu.ft. each. The rig has to be erected and dismantled for each 300 cu.ft. of muck. Inevitably, time is lost at the beginning and end, and also in waiting for cars. As a consequence only a small differential is in favor of the scraper loader as compared with efficient shoveling from slick sheets. However, where it is possible to have several development workings under way on a given level, and if the work of drilling, blasting, timbering, and mucking can be systematized, scraper loading should possess a definite advantage. Likewise, when the cross-section of the development working is larger, the use of a scraper loader may prove advantageous.

Can the Shovel Be Eliminated?

A great deal of effort and experimentation has gone into the problem of eliminating the muck stick underground, and considerable progress has been made. As an example, at the Sullivan mine, Kimberley, B.C., development in the footwall is mechanically mucked, and in the stopes ore is drawn by heavy scrapers to the transfers where it will not run by itself. Development workings are all of generous cross-section and the stopes are on a footwall of about 20 deg. slope and are high and wide. Similarly, in the sheet ground in the Tri-State area and southeast of Missouri, mechanical loaders have become established in larger properties. At Mascot, Tenn., scrapers are used in chambers of low inclination to bring ore to transfers. In limestone mines, power shovels are used in some instances. Almost all these examples fall into the group of low-inclination or flat deposits. In the iron-mining districts, where top slicing is employed, scrapers and some power loaders are in extensive use. Scraping to an ore transfer and loading by means of chute and gate has been developed in many mines where top slicing is practiced.

Motor Haulage Used Underground Where Tonnage Warrants

Locomotive transportation by trolley, storage-battery, or compressed-air type locomotive is almost universally practiced in metal mines where the tonnage and distance justify the installation cost. In mines of small tonnage output and where distance is small, hand tramming is in vogue. Where a small tonnage (50 to 100 tons per day) must be transported over considerable distances (1,500 to 5,000 ft.) mule haulage is employed. Compact, small, storage-battery locomotives are now available and may often be substituted for mule haulage to advantage. At least two manufacturers have produced locomotives of the storage-battery type, that are small enough to be moved from level to level on a mine cage and yet made so as to give efficient service. Where adopted these small locomotives have served to lessen the number of hand-trammers and of mules and drivers. Their small size permits their use on other than the main haulage levels. Wire-rope haulage, although it has some advantages is

too inelastic for most metal mines. Internal-combustion engine locomotives are used to a considerable extent in limestone, gypsum, clay, and road-metal quarries. Gas-electric locomotives have also been used in open-pit work as well as steam locomotives.

Why Not Use Belt Conveyors?

Is there a field for belt conveyors underground, is a question frequently asked. Locomotive haulage has apparently answered in mines where large tonnages have to be moved. Loads are received at several points where the ore is dropped into cars from chutes. Tracks are necessarily installed in all development workings upon a given level, and locomotive haulage lends itself to convenient service to all parts of a level. It is obvious that the belt conveyor installation is not mobile and may be expected to receive loads from comparatively few points and to deliver to one point.

A condition sometimes exists in a mine where ore must be delivered from a transfer to a shaft pocket over a relatively long period of time. In such a situation a belt conveyor might effect a saving in labor and operation over locomotive or other means of transportation; but for general service upon a given level in a metal mine, the conveyor possesses many obvious disadvantages.

Situations where the conveyor could be used to advantage underground are not numerous. Apron-plate feeders have been installed at the Porphyry shaft of the Inspiration Consolidated Copper Co. for delivering ore from the pockets to the skip measuring bins. This suggests the placing of ore pockets at a distance from the shaft and the use of a larger conveyor controlled by push buttons placed at the shaft-loading points. The arrangement would avoid a large excavation in close proximity to a working shaft, and this would be an advantage in some instances. Where the stability of the shaft is not in question no advantage would accrue.

A Trend Toward Use of Larger Cars

Cars for underground service are necessarily restricted in size, but the tendency to increase sizes to the maximum permissible with the cross-section of haulageways is marked in mines of large tonnage. Cars of 4 or 5 tons' capacity are not uncommon, but in large adits cars up to 10 to 12 tons and more are in use. In stopes and restricted workings, where hand tramming is necessary, cars of 18 to 20 cu.ft. capacity prove the handiest. Some mines have adopted 30 and 40 cu.ft. sizes. Three sizes of cars have been found necessary in the larger mines, whereas in the smaller properties the 18 to 20-cu.ft. car is in general use.

Cars may be classified into certain standard types—end- and side-dump cars, gable, bottom side-dump, rocker side dump, Granby, and solid bottom. Revolving dumpers are required as accessory equipment to solid-bottom cars. Roller bearings are in general use, and at least one manufacturer has made use of ball bearings.

Mechanical Ventilation More Widely Practiced Than Before

Controlled ventilation is generally accepted practice in all large mines. Especially in deep, hot mines a complete mechanical equipment is necessary at the surface and underground. Electrical operation of ventilating fans has simplified installations to a high degree. Compressed air is an alternative power agent. Dependable equipment is supplied by many manufacturers, classified into large fans, with direct, belt or silent chain drive for general mine ventilation; smaller fans for local ventilation, usually direct-driven by motors and mounted on trucks or stationary; and air "stirrers" for use in stopes. The last named are operated by air or electric motor. Flexible or metal piping is used for local distribution of air in raises, stopes, and to dead ends.

The necessity for mine drainage does not always exist and sometimes may be effected by adits, but equipment for this purpose is generally necessary in open-pit and underground operations. Pumps, air lifts, and bailers are the three types of machines used for elevating water. Water jets (hydraulic ejector) are sometimes used for low lifts in shaft sinking. Pumps fall into several groups: multiplunger single-acting (vertical type); horizontal double-acting plunger; compressed-air and electric-motor sinking; multi-stage centrifugal and deep-well pumps of the turbine type. Electric power has displaced air except for sinking pumps and has resulted in material improvement in mechanical design and efficiency of pumping machinery. The tendencies of practice are to concentrate pumping stations in as few lifts as possible, 2,000 to 3,000 ft. in one lift, and to make operation and control of units automatic where practicable. Mechanical engineers and manufacturers of mine pumps, it may be said in general, have perfected their product.

Hoisting Perfected—Manual Control Eliminated at Some Plants

Major hoisting service is represented by a long period of development in mechanical design. Electric motor-driven hoists have displaced steam and compressed-air hoists to a large extent, regardless of depth. Safety appliances have been perfected for automatic control. Electric signaling systems have been designed to operate under severe service conditions. Auxiliary telephone circuits supplement the visual and auditory signals. Automatic hoist operation has been devised and operated successfully. Hoisting ropes under competitive manufacturing have become standardized. Hoisting accessories, cages, skips, and bailers, as well as on-setting and off-setting apparatus, have been progressively developed and improved.

Notable Advance in Skip-Loading

Skip loading began with simple gate arrangements and spouts contiguous to the shaft compartments. The next improvement was the addition of compressed-air cylinders for the operation of the ore-pocket gates. The measuring pocket holding a single skip load was added next and increased the certainty of rapid loading. Probably the most elaborate skip-loading rig is at the Porphyry shaft of the Inspiration mine, where apron-plate feeders are interposed between the ore pockets and the skip-loading bins. This arrangement facilitates the removal of waste timber from the ore.

The metal miner wherever practicable has taken advantage of gravity and has consistently used ore transfers and ore passes for vertical or inclined-ore movement. Chute gates, of the manual and air-cylinder types, have been devised to control ore flows in loading. A wide variety of designs has been described in *E. & M. J.*, indicating the variation in individual conditions. No doubt there is opportunity to standardize some of these designs and place them on the market.

Two mechanical appliances are available for exploration underground. One is the diamond drill, which has been mechanically perfected until it can be considered standard, and the other is the "long drill" or the com-

bination of a heavy rock drill and sectional drill steel. For the softer rock the last named has proved to be advantageous and by its adoption useful information as to formations and ore occurrences can be obtained at lower cost than by driving exploration workings.

Open-Pit Practice Completely Mechanized at Many Mines

The primary operations in open-pit mines are drilling, blasting, excavation, loading, transportation, dumping, dump spreading, and track shifting. Mechanization of these operations has been thoroughly developed wherever it is practicable to use machines. In drilling, well drillers and hammer and rotary drills are extensively used. For excavation and loading, continuous-tread power shovels—steam, electric, and internal-combustion—are standard practice in both large and small operations, although some of the latter employ hand loading where the quarry output is irregular and of too small an aggregate tonnage to warrant capital investment in loaders. Under the last-named conditions it should be feasible to use a small loader of the underground type.

For transportation—steam, gas-electric, gasoline, and storage—third-rail and trolley-type locomotives are available for motive power, and side-dumping (power) cars for both waste and ore are obtainable in sufficient variety to meet most of the conditions in open-pit mines and quarries. In small operations, horses and mules are employed. Under conditions where track laying can be avoided, auto trucks of heavy design are employed to transport ore and waste rock over short distances, as is exemplified in the United Verde open pit.

Where overburden must be removed and dumped, railroad spreaders have proved to be advantageous by reducing the number of track shifts necessary in extending out the dumps. Track shifting, always a feature of open-pit work and of waste-dump building, was formerly a detail that required a high proportion of labor. Track-shifting machines have made a material reduction in the labor required for this purpose. Locomotive cranes are also a useful accessory in large-scale operations. The gold dredge is an example of a self-contained excavating, transporting, washing, and waste-disposal machine that has been perfected in design and construction by many engineers and operators over some twenty years.

Are Further Improvements Possible?

What are the possibilities of using additional mechanical equipment underground? Mining is a relatively simple problem of excavation, loading, transportation. Since the days of primitive mining, miners, operators, and engineers have had as their objectives "least work" for a given objective. Our own times are characterized by the use and perfection of many machines useful in mining. Reduction in the number of workers to deliver a given tonnage from a mine has been progressive. If accurate statistics over a number of years were available, the rate of increase in tons per man-shift underground would show a rapid rise; but it is obvious that this rate of increase can now proceed only slowly, for it is probable that further revolutionary changes (improvements) will occur, if they do, at long intervals. In each mine there is a limit to which mechanization can be developed to best technical advantage. For the future, improvements will be made in better machinery (design and selection of materials), improved methods of working, and the thorough training of miners.

Mineral Resources of Morocco

THE French Morocco office has published a report on the mineral resources of Morocco which leaves little doubt that future prosperity lies in the development of these important sources of wealth. Mines already prospected and surveyed are only one phase of the question, but reports and small natives' workings suggest greater potential resources than those already developed.

The mining law of the Moroccan protectorate may be summarized as follows:

No mining rights are granted, for the moment, in the areas which are still closed by the military authorities as a precaution for the security of Europeans. The regions closed to investigation are believed to be the richest of all. In the various zones where it is possible to travel freely under the protection of the colonial government prospecting will be allowed. Permits are granted, to be renewed annually. The areas open to prospecting are bounded by a line four kilometers in length from east to west and north to south, forming squares of sixteen square kilometers.

If developments are encouraging an exploitation permit valid for five years is granted. This can be extended to twenty-five years or, in discovery of oil, to thirty years.

Permits and concessions must be for a specific substance—fuels, metals, salts, or hydrocarbons. Under certain conditions, concessions may be put up at public auction.

All phosphate deposits are reserved for the state.

In addition to annual taxes based on surface area the concession holders will contribute a sum equal to 5 per cent of the value of all products exported.

Morocco is not known to contain reserves of fuel. As yet no coal deposits which give promise of commercially successful exploitation have been discovered.

The Office Chérifian des Phosphates exploits at Kourigha a deposit of high-grade phosphate of 76 per cent. An important deposit of manganese is found in the Djebel Bou-Arfa, 120 kilometers northwest of Figuig. Iron-ore deposits are found at Tiflet and at Kraloua to the east of Rabat.

Lead is very widely distributed in Morocco. The greater number of prospecting permits are granted specifically for this metal. The principal deposits are found to the south of Oudjda (within a radius of 40 kilometers) in the Djebel Mekan (between Berguent and Debdou), in the region of Midlet, in the Atlas mountains, the Djebelit, and in Rehamna to the north of Marrakech. There are deposits of zinc in the Djebel Ouichedden and the Djebel Erdouz (Goundafa) and in Djebel Bou Dahar, to the north of the Bou Denib. Prospecting for copper up to the present has given no results. A deposit of tin has already been worked for several years near Oulmes.

Minerals exported in 1926 were for the most part the result of prospecting work as distinct from exploitation. Phosphate comes in the category of complete exploitation. The following are the figures:

	Metric Tons	Value in Francs
Phosphate	885,000	110,625,000
Lead	3,000	5,327,000
Copper	410	185,000
Manganese	305	243,000
Tin	8	195,000
Molybdenum	4	62,000

Molybdenum has been found in the region of Amizmiz and was exploited by two companies, although each has suspended operations.

USEFUL OPERATING IDEAS

Standard Curve Computations

By A. D. Rood

THE work of laying out curves on surface, where the sight is unobstructed, differs from underground problems of the same nature in that the underground surveyor must choose chord points along the center line of the curve at intervals which allow a sight to be taken between adjacent points. In cases of narrow drifts and curves of short radii these points must, of necessity, be relatively close together. As circumstances permit, the distance between chord points may be increased to about 40 ft., which is near the practical limit for distance between line points and working face in uncertain light.

Since both ends of the curve must be located, the surveyor's work may be greatly facilitated by choosing equal chord distances. By doing so, methods are simplified in two ways. First, the number of set-ups required to carry the survey around the curve may be decreased, and, second, one computation is standard for all the courses of each particular curve.

For survey purposes, underground curves may be divided into the following two classes: first, those of short length which permit a set-up under the P. I., and second, those of greater length, whose P. I. falls outside the drift or so close to the side that a set-up under that point is impossible. In the first case, chord computations are not necessary and one set-up under the P. I. is sufficient for the whole curve. Fig. 1 shows the maximum central angle which permits a set-up under the P. I. for a drift 7 ft. 6 in. wide and curve of 60 ft. radius. Fig. 2 shows maximum equal chord distances for a longer curve which may be used under the same condi-

Chord Distances For Curves of 60 Deg. Radius Given the Deflection Angle

	Degrees														
Feet	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
0	16.71	18.79	20.83	22.89	24.96	27.01	29.01	31.05	33.07	35.08	37.07	39.07	41.03	43.01	44.95
1	16.74	18.82	20.86	22.92	25.00	27.04	29.04	31.08	33.10	35.11	37.10	39.10	41.06	43.04	44.98
2	16.77	18.85	20.89	22.95	25.04	27.07	29.07	31.11	33.13	35.14	37.13	39.13	41.09	43.07	45.01
3	16.80	18.89	20.92	22.98	25.08	27.10	29.10	31.14	33.16	35.17	37.16	39.16	41.12	43.10	45.04
4	16.83	18.93	20.95	23.01	25.12	27.13	29.13	31.17	33.19	35.20	37.19	39.19	41.15	43.13	45.08
5	16.86	18.97	20.98	23.04	25.15	27.16	29.16	31.20	33.22	35.23	37.22	39.22	41.18	43.16	45.11
6	16.90	19.01	21.02	23.07	25.18	27.19	29.19	31.23	33.25	35.26	37.25	39.25	41.21	43.19	45.14
7	16.93	19.04	21.06	23.10	25.21	27.22	29.22	31.27	33.28	35.29	37.28	39.28	41.24	43.22	45.17
8	16.97	19.07	21.10	23.13	25.24	27.25	29.26	31.31	33.31	35.32	37.31	39.31	41.28	43.26	45.20
9	17.01	19.10	21.13	23.16	25.27	27.28	29.30	31.35	33.34	35.35	37.34	39.35	41.32	43.29	45.23
10	17.05	19.13	21.17	23.19	25.30	27.31	29.34	31.38	33.38	35.38	37.37	39.38	41.36	43.32	45.26
11	17.09	19.16	21.21	23.23	25.33	27.34	29.38	31.42	33.42	35.41	37.40	38.41	41.40	43.35	45.29
12	17.13	19.19	21.25	23.27	25.37	27.37	29.41	31.46	33.46	35.45	37.46	39.45	41.43	43.39	45.32
13	17.17	19.22	21.29	23.31	25.40	27.41	29.45	31.50	33.50	35.49	37.50	39.49	41.44	43.42	45.36
14	17.20	19.25	21.33	23.35	25.44	27.45	29.49	31.54	33.54	35.53	37.54	39.53	41.48	43.46	45.40
15	17.24	19.29	21.37	23.39	25.47	27.49	29.53	31.58	33.58	35.57	37.58	39.57	41.52	43.49	45.43
16	17.27	19.33	21.41	23.42	25.50	27.52	29.56	31.61	33.61	35.60	37.61	39.60	41.55	43.52	45.46
17	17.30	19.36	21.45	23.45	25.53	27.55	29.59	31.64	33.64	35.63	37.64	39.63	41.58	43.55	45.50
18	17.33	19.39	21.48	23.48	25.56	27.58	29.62	31.67	33.67	35.66	37.67	39.66	41.61	43.58	45.53
19	17.37	19.42	21.51	23.51	25.59	27.61	29.65	31.70	33.70	35.69	37.70	39.69	41.64	43.61	45.56
20	17.40	19.45	21.54	23.54	25.62	27.64	29.69	31.73	33.73	35.72	37.73	39.72	41.67	43.64	45.59
21	17.43	19.48	21.57	23.57	25.65	27.67	29.72	31.76	33.76	35.75	37.76	39.75	41.70	43.67	54.62
22	17.46	19.51	21.60	23.61	25.68	27.70	29.75	31.79	33.79	35.78	37.79	39.78	41.73	43.70	45.65
23	17.49	19.54	21.63	23.65	25.71	27.74	29.78	31.82	33.82	35.82	37.83	39.82	41.76	43.73	45.68
24	17.53	19.58	21.66	23.69	25.74	27.78	29.81	31.85	33.85	35.86	37.87	39.85	41.79	43.77	45.71
25	17.57	19.62	21.69	23.72	25.78	27.82	29.84	31.88	33.88	35.90	37.91	39.88	41.82	43.80	45.75
26	17.61	19.66	21.72	23.76	25.82	27.86	29.88	31.91	33.92	35.93	37.94	39.91	41.86	43.84	45.79
27	17.64	19.70	21.75	23.80	25.86	27.90	29.92	31.95	33.96	35.97	37.98	39.94	41.90	43.87	45.82
28	17.67	19.74	21.79	23.84	25.89	27.93	29.96	31.99	34.00	36.01	38.02	39.97	41.94	43.91	45.85
29	17.70	19.78	21.83	23.88	25.92	27.97	30.00	32.03	34.04	36.05	38.05	40.00	41.98	43.95	45.89
30	17.73	19.82	21.87	23.92	25.96	28.01	30.04	32.07	34.08	36.09	38.08	40.04	42.02	43.98	45.92
31	17.76	19.85	21.91	23.95	25.99	28.04	30.07	32.10	34.11	36.12	38.11	40.07	42.05	44.01	45.95
32	17.80	19.88	21.94	23.98	26.02	28.07	30.10	32.13	34.14	36.15	38.14	40.10	42.08	44.04	45.98
33	17.84	19.91	21.97	24.01	26.05	28.11	30.13	32.16	34.17	36.18	38.17	40.13	42.11	44.08	46.01
34	17.88	19.94	22.00	24.04	26.08	28.14	30.16	32.19	34.20	36.21	38.20	40.16	42.14	44.11	46.04
35	17.91	19.97	22.03	24.08	26.11	28.17	30.19	32.22	34.23	36.24	38.23	40.19	42.17	44.14	46.07
36	17.94	20.00	22.06	24.11	26.14	28.20	30.22	32.25	34.27	36.27	38.26	40.22	42.20	44.18	46.11
37	17.97	20.03	22.09	24.14	26.18	28.23	30.25	32.28	34.30	36.30	38.29	40.23	42.23	44.21	46.15
38	18.00	20.06	22.12	24.17	26.22	28.26	30.28	32.31	34.33	36.33	38.32	40.27	42.26	44.24	46.18
39	18.03	20.09	22.16	24.21	26.26	28.29	30.32	32.34	34.36	36.36	38.35	40.31	42.29	44.27	46.21
40	18.06	20.12	22.20	24.25	26.30	28.32	30.36	32.37	34.39	36.39	38.38	40.35	42.33	44.30	46.24
41	18.09	20.16	22.24	24.29	26.34	28.35	30.40	32.41	34.42	36.42	38.42	40.39	42.36	44.33	46.27
42	18.12	20.20	22.28	24.33	26.38	28.39	30.44	32.45	34.46	36.46	38.46	40.43	42.40	44.36	46.30
43	18.16	20.24	22.32	24.37	26.42	28.43	30.48	32.49	34.50	36.50	38.50	40.47	42.44	44.39	46.34
44	18.20	20.28	22.36	24.41	26.46	28.47	30.52	32.53	34.54	36.54	38.54	40.51	42.47	44.42	46.37
45	18.24	20.32	22.40	24.45	26.50	28.51	30.56	32.57	34.58	36.58	38.58	40.55	42.51	44.45	46.40
46	18.28	20.35	22.44	24.48	26.53	28.54	30.59	32.60	34.61	36.61	38.61	40.58	42.54	44.48	46.43
47	18.32	20.39	22.48	24.51	26.56	28.57	30.62	32.63	34.64	36.64	38.64	40.61	42.57	44.51	46.46
48	18.36	20.42	22.52	24.54	26.59	28.60	30.65	32.66	34.67	36.68	38.67	40.64	42.60	44.54	46.49
49	18.40	20.46	22.55	24.57	26.62	28.63	30.68	32.69	34.71	36.71	38.70	40.67	42.63	44.57	46.52
50	18.44	20.50	22.58	24.60	26.65	28.66	30.71	32.72	34.74	36.74	38.73	40.70	42.66	44.60	46.55
51	18.47	20.54	22.61	24.63	26.68	28.69	30.74	32.75	34.77	36.77	38.76	40.73	42.69	44.63	46.59
52	18.50	20.57	22.64	24.66	26.71	28.72	30.77	32.78	34.80	36.81	38.79	40.76	42.73	44.67	46.63
53	18.53	20.60	22.67	24.70	26.74	28.75	30.80	32.81	34.83	36.85	38.82	40.79	42.76	44.71	46.66
54	18.56	20 63	22 70	24.73	26 77	28.78	30 83	32.84	34.86	36.89	38.85	40.82	42.80	44.75	46 69
55	18.59	20 66	22.73	24.76	26.81	28 82	30 86	32 87	34.89	36.92	38.88	40.85	42.83	44.78	46 72
56	18.63	20 69	22.76	24.80	26.85	28.86	30 89	32.91	34.93	36.95	38.91	40.88	42.87	44.82	46 75
57	18.67	20.72	22.79	24.84	26.89	28.89	30.93	32.95	34.97	36.98	38.95	40.92	42.90	44.85	46.78
58	18.71	20.76	22.82	24.88	26.93	28.93	30.97	32.99	35.01	37.01	38.99	40.96	42.94	44.88	46.82
59	18.75	20.79	22.85	24.92	26.97	28.97	31.01	33.03	35.04	37.04	39.03	41.00	42.97	44.92	46.85

Note: Deflection angle = ½ central angle. Distances are in feet.

tions as the first. The maximum subtending, or central angle for a single chord in the particular case shown, is about 44 degrees.

The accompanying table of chord distances was computed for curve work where 60-ft. radius is used almost

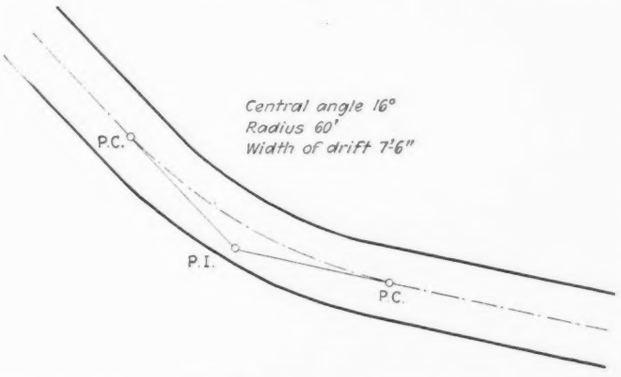


Fig. 1—Showing the maximum central angle which permits a set-up under the P. I. and the consequent reason for the lower limit of the chord table

entirely. However, the table may be used for curves of different radii, since chord lengths for the same deflection angle are directly proportional to their respective radii. The computations were made for fifteen-minute

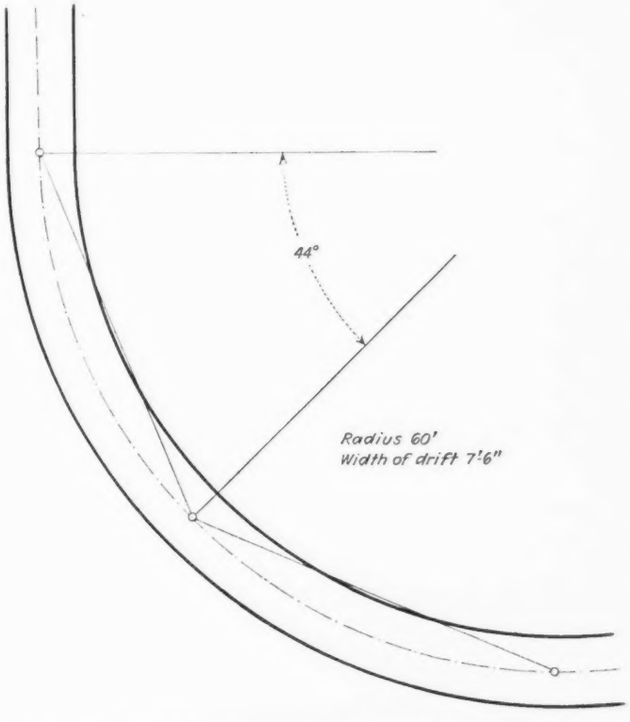


Fig. 2—Showing the maximum central angle which permits a sight between adjacent points and the consequent reason for the upper limit of the chord table

intervals between 8 deg. and 23 deg. with seven-place logarithms. Figures remaining represent interpolations along a straight line between these intervals. The difference between the locus of chord distances of a 60-ft. radius curve and a straight line between deflection angle intervals of fifteen minutes is less than 0.01 ft. Therefore the straight line interpolation may be taken as correct for ordinary survey work. In the same way, if the central angle is not divisible an even number of times by two, then a straight line interpolation between adjacent figures in the table is entirely reasonable.

How to Straighten Gyratory Shafts

By C. B. Strachan

After several years of operation it was found that the crusher shafts in the No. 8 crushers in the mill of the Mascot mine of the American Zinc Co. of Tennessee, at Mascot, Tenn., were bent. This evidently had been caused by tramp steel, such as car wheels and boulder hammers, getting into the crusher. The large size of the mine ore did not permit of the use of a magnet or other device to prevent the tramp steel from getting into the crusher. The bend in the shaft caused the eccentric to heat so that it was necessary either to buy a new shaft or straighten what we had. Finally the conclusion was reached that if the bend had been put in the shaft in a few seconds' operation the same method could be reversed and the shaft straightened by taking a longer period of time to do it. We therefore sent the shaft to the shop, located the position of the bend and its amount, the position of the bend being marked on the top of the shaft. The shaft was then put back in the machine in operating condition. It was not allowed to revolve but was held in one position with the maximum curvature to one side of the leg of the spider so that there would be less spring to the spider and also that there would be less likelihood of breaking it. The distance between the head and the concaves was then measured by interposing cubes of lead of different size. These were measured after being slightly compressed by the stroke of the crusher, which was revolved slowly to obtain the measurement.

The first shaft straightened had three-quarters of an inch bend. We were now ready to attempt straightening the shaft. This was done by interposing three $\frac{15}{16}$-in. shafting cut to $\frac{1}{4}$ in. longer than the measurement obtained by the lead cubes. The crusher was then revolved slowly and the pieces of shafting were interposed. After three pieces had been used it was found that we had shoved the shaft back about $\frac{1}{8}$ in. This measurement was obtained by interposing new lead cubes. The procedure was kept up until the shaft had been pushed back the full $\frac{3}{4}$ in. Apparently the shaft stood the bending cold, as it has since been in operation for six months, working perfectly. The same procedure was followed on the second shaft with satisfactory results. The value of the straightened shaft was approximately $800; whereas the cost of straightening it would not exceed $30.

Temperature of Solutions Flowing in Pipes

By Charles Labbe

To determine the approximate temperature of a solution flowing through a pipe, clean the side of the pipe line so as to secure a good contact. A glass thermometer is then laid on the pipe with a small chunk of putty over the mercury bulb to confine the heat and the whole is fastened with tape at two points. The thermometer is placed where it is not liable to be damaged by mud or dripping water and also in a position away from air currents.

NEWS OF THE WEEK

Summary

H. A. GUESS, vice-president in charge of mining of the American Smelting & Refining Company, states Buchans River operations indicate presence of 3,000,000 tons of high-grade lead-zinc-copper ore.

* * *

A party of metallurgists from Soviet Russia visits Butte in the course of a six months' tour of the various reduction plants in this country. One of the party states that the Russian government has subsidized mining work to the extent of $250,000,000.

* * *

As the result of an underground inspection of the Seneca mine, in the Michigan copper district, by the officials of the Mohawk Mining Company, interest in the possible acquisition of the Seneca property by the Mohawk company revives.

* * *

Attorney General of Ontario continues the clean-up of questionable brokerage houses and makes more arrests. Gold mine operators in the North wish the department would give the same attention to high-grading.

* * *

Gold Ore and Tom Reed companies, of Oatman, Ariz., conclude arrangements for the sinking of a three-compartment, 1,000-ft. shaft near the Aztec vein on the Tom Reed estate.

* * *

Bodies of all of the seven men killed in an air blast at the Quincy mine, in the Michigan copper district, are recovered; a recent fire is held responsible for the blast.

* * *

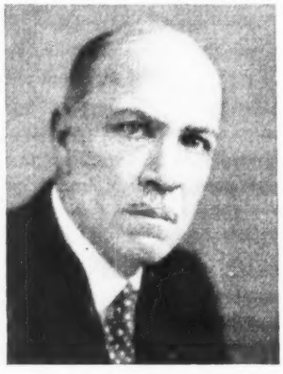
Tin interests in London are still unable to reach a workable agreement; an official statement is promised by the parties who initiated the movement.

J. W. Furness Appointed Chief of New Mineral Division

Succeeds Marshall W. Tuthill, Who Leaves Service—Action Marks Further Step in Co-ordination of Bureau of Mines and Bureau of Foreign and Domestic Commerce

By Paul Wooton
Special Washington Correspondent

AS A FURTHER step in the co-ordination of the work of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce, both in the Department of Commerce, James William Furness, a mining engineer who has been connected with the minerals-metals division of the economics branch of the Bureau of Mines, has been chosen for the position of chief of the mineral division of the Bureau of Foreign and Domestic Commerce. Mr. Furness succeeds Marshall W. Tuthill, who has resigned to form a company of his own, specializing in foreign trade in minerals, metals, and ores. Mr. Tuthill came to Washington last July at the request of Secretary Hoover to make a study of the correlation of the export trade work in minerals of the Bureau of Foreign and Domestic Commerce with the work of the Bureau of Mines.



J. W. FURNESS

Mr. Furness, who is widely known in the mining industry, was born in Philadelphia in 1874. A review of his commercial experience follows: From 1895 to 1900 he was with the Golf Mining & Milling Company, lessee of the Murray Murphy Mining Company, Chalk Creek, Chaffee County, Colo., as assayer, miner, assistant superintendent of the concentrating mill, and assistant metallurgist to the Buena Vista Smelting & Refining Company, a subsidiary of the Golf Mining & Milling Company. During this period he personally operated and leased properties in Leadville, Colo. He also operated leases on a portion of the A. Y. & Minnie, Mike Star, and Across the Ocean mines.

From 1900 to 1901 Mr. Furness was assayer to the Golden Cycle Mining Company and the Hull City Mining Company, Cripple Creek, Colo. From 1901 to 1907 he was associated with D. M. Barringer as consulting engineer with headquarters in Philadelphia. During this period he made extensive examinations of iron-ore deposits along the western coast of Mexico and in Guatemala, and also examined mines of gold, silver, lead, manganese, and iron in the Western states, and later was employed in a consulting capacity by the Pennsylvania Dredging Company, Clear Creek, Shasta County, Calif. He purchased, developed, and operated the Palmarito mine, in Mexico, for the Palmarito Mining Company, of which he was vice-president. Later he was employed in the development work on the Coon Crater mine, in Arizona, developed the Head Light mine, a gold property in Shasta County, Calif., and examined properties in southeastern Alaska and British Columbia. Until 1909 he operated as lessee the Nash hydraulic mine, in Trinity County, Colo.

From 1909 to 1918 Mr. Furness was consulting engineer to C. A. Robertson, of Sacramento, Calif., in charge of the engineering features in connection with the development of large tracts of irrigable land in California and Utah. He operated as lessee the Meadow Valley silver mine, a subsidiary of the Pioche Consolidated Mining Company, Pioche, Nev., and examined coal mines in Belgium and France. From 1919 to 1921 he operated the Lucky Cuss silver mine

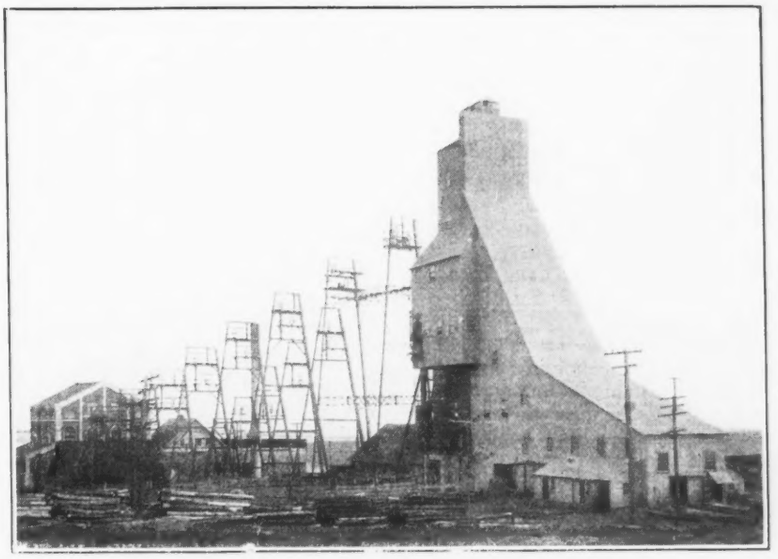
near Tombstone, Ariz.; the Commonwealth silver mine at Pierce, Ariz.; the Sadalia copper mine in Colorado; and the Dog Creek gold properties in Trinity County, Calif., as lessee. In 1920 he examined the manganese situation in England and France, and made a reconnaissance of the Caucasus manganese situation. From 1922 to the present he has served as mining engineer, Bureau of Mines, minerals-metals division, economics branch, in Washington, D. C. In 1926 he was appointed special reserve officer with the rank of major and detailed to the Industrial War College.

Tuscumbia and Idora Mines Leased

Seattle interests represented by A. F. Alcorn have secured a bond and lease on the lead-silver property of Tuscumbia Mining Company, situated about 8 miles north of Wallace in the Coeur d'Alene district, Idaho. This property consists of four claims which were extensively developed for a good many years and from which large shipments were made by leasers. According to report, the consideration is $100,000, the first payment to be made on July 1, 1928. The same people have also secured the Idora property, joining the Tuscumbia, the main tunnel of which extends into the Tuscumbia and provides an operating outlet for both properties. Like the Tuscumbia, the Idora was quite productive, but has been inactive for many years. The Idora has a mill of 100 tons' capacity, but its equipment is out of date and it is understood that the Seattle people plan to transform it into a flotation plant. Arrangements are being made with the Washington Water Power Company to restore the electric power line to the Tuscumbia and Idora before winter weather sets in, the two properties being situated high up on Sunset peak and subject to exceedingly heavy snows.

Premier Starts Tunnel to Open Extension of Lode

The Premier Gold Mining Company, having nearly completed a camp for 50 men at the Prosperity group, on the north fork of the Salmon River, in the Portland Canal division, is about to start a 1,500-ft. tunnel, to open the extension of the Porter-Idaho lode at a depth of about 400 ft. This work will be pushed throughout the coming winter. Recently the Porter-Idaho Mining Company cut the lode in a tunnel on its territory at a depth of 400 ft. The lode is reported to be seven feet wide at the point of intersection, two feet of which is solid galena well impregnated with native silver and silver sulphides, similar to that now being mined in the levels above; the remainder of the lode at this intersection is a good grade of millisg ore.



No. 2 Shaft of the Quincy Mining Company

Recent Fire at Quincy Mine Held Responsible for "Air Blast"

Operations Suspended Following Recovery of Seventh Body—District Has Low Accident Rate—Mohawk Officials Inspect Underground Workings at Seneca

TRAGEDIES such as that which occurred in the Quincy mine on Oct. 29, when seven timbermen lost their lives in an "air blast" in No. 2 shaft, are unusual in the Michigan copper district, where a low accident rate prevails. For the year ending Oct. 1 there were only six fatalities in all of the mines of the district, or a percentage of 0.0012 of the number of men employed underground. Quincy has been unfortunate in this year's operations, as a result of the fire in No. 2 shaft in July, which put the shaft out of operation and made extensive repairs necessary. The fire incidentally was the cause of the Oct. 29 tragedy. "Air blasts" usually occur in the upper or worked-out part of the mine, where men are not ordinarily at work. The first active level below the 41, where the men were killed while repairing the fire damage in the shaft, is the 77. Previous to this deplorable tragedy, few men had lost their lives by "air blasts" in Quincy's 79 years of operation.

Operations were suspended in Quincy, following the recovery of the seventh body of the victims, the morning of Nov. 1, to give the rescue crews a much-needed respite and permit the ground to settle. During the course of the dangerous task of recovering the bodies, "air blasts" occurred at intervals. It is believed that the explosions were caused by the contraction of the rock which was heated and expanded by the fire in July. The shaft, where timbered above the 40 level, is intact, showing that the timbers are supporting the ground. It is expected that mining operations will be resumed in No. 6 shaft this week and possibly repair work done in No. 2.

A recent inspection of the underground workings of Seneca, both in the Seneca and Gratiot shafts, by officials of the Mohawk Mining Co., has revived interest in the possible acquisition of Seneca by Mohawk. Seneca, which has encouraging prospects physically, could be advantageously worked by Mohawk, which property adjoins. Mohawk has its own railroad facilities, stamp mill and an interest in the Michigan Smelting Co. Seneca, in the opinion of many, offers inviting possibilities to Mohawk in view of its close proximity and advanced stage of development. Seneca shareholders, meanwhile, are without word as to the possible intentions of the company.

Operating Forces Increased

A slackening of activity in industrial fields in the Middle West is responsible for the return of many former residents to the Michigan copper district, where they are finding employment. The mining companies, particularly Calumet & Hecla Consolidated, are taking on men daily, and as a result the mines are better supplied with labor than they have been in a number of years. This is enabling them to keep well-balanced forces in underground departments and to do considerable important development and exploration work. Dwellings which have been vacant for several years are being occupied and others are being renovated as the demand for homes increases. The improvement in conditions is especially noted at Calumet. Calu-

met & Hecla is repairing dwelling houses from Ahmeek as far south as Osceola to accommodate all those coming back to find work there.

Coal Rate Hearings Announced

The Interstate Commerce Commission has announced coal-rate hearings Nov. 16 at Washington and Nov. 29 at Minneapolis affecting Lake cargo coal from Kentucky, Tennessee, Virginia, and West Virginia to Lake Erie ports. The coal-carrying railroads from these fields voluntarily reduced the rate 20c. a ton, but the rate was suspended by the commission pending investigation. If the reduced rate is finally ratified, it will prove beneficial to the mining companies of the Michigan copper district which get their coal supplies from the southern fields and result in the saving of many thousands of dollars in coal-carrying charges.

News of Other Properties in the District

Owing to the efficiency of its well-balanced underground force, the continued enrichment of No. 6 shaft, and mill improvements, Mohawk will report the lowest costs this year since 1915, when wages, material, and supplies were considerably lower than prevailing rates. Production for the year should be 20,000,000 lb. of refined copper, or better. The stamp mill improvements have made the plant one of the most modern in the district. Concrete rock bins and new rails were recently installed and the entire building has been concreted and made fireproof. The new regrinding units are doing effective work in cutting down the copper losses.

At Calumet & Hecla Consolidated's Cliff property in Keweenaw County, which, with Phoenix, will be used for exploratory work, No. 4 shaft has been drained to the 700 level. It is estimated 500 ft. remain to be dewatered. This shaft will be overhauled down to the 13 level, at which point it connects with the Avery shaft. A small electric hoist is to be installed at No. 4. At Phoenix, the vertical old Crocker shaft has been drained for 400 ft., or approximately one-third of its depth. There also is an incline shaft, 2,600 ft. deep, on this property. The Crocker shaft is in fairly good condition, but the incline shaft is almost filled with débris. It probably will be spring before any actual exploratory work is started by the company on the Cliff property.

Good values continue to be opened in the new amygdaloid vein which was encountered by Calumet & Hecla Consolidated in the crosscut from the 417 level of Allouez No. 2 shaft. This lode is 1,400 ft. west of the shaft and 600 ft. west of the Calumet conglomerate. It is an entirely new vein. Developments in this formation are important to Mohawk for the lode passes through Mohawk lands west of the Wolverine.

Shipment of conglomerate sand from the site of the first Calumet stamp mill, at Calumet, to Calumet & Hecla Consolidated's reclamation plant at Lake Linden has been discontinued for the winter. The old tailing deposit is small in comparison with the deposits of the mills on Torch Lake, but the sand is high in copper content owing to the crude methods of early-day treatment of the conglomerate rock.

The plan of deepening the New Baltic shaft several hundred feet is being considered. The present bottom level is the 1,250, from which a crosscut entered the Arcadian lode. This vein is wide and contains copper values. It is believed that substantial values in this and other formations will be found at greater depth. Meanwhile, opening of the lode at the 1,250 will be pushed.

Arcadian, which is working in the north end of its property, is developing a territory in which no previous exploratory work ever was done. It is in the same horizon at which Isle Royale obtained its best values at depth.

Michigan copper country witnesses have returned from Tucson, Ariz., where a suit brought by the Carson Investment Company against the Calumet & Arizona Mining Company and the Phelps & Dodge Corporation for alleged infringement of Carson patents for side-wall furnace feeding in smelter practice was heard in the United States District Court. The suit was taken under advisement by the court.

Frank Pardee, mining engineer, has been named appraiser of mines for the Michigan State Tax Commission to succeed L. P. Barrett, who resigned to accept a position with the Jones & Laughlin Ore Company.

H. A. Guess Issues Statement Regarding Buchans River Operations

Exploration Work and Assays Indicate Presence of 3,000,000 Tons of High-Grade Lead-Zinc-Copper Ore—Lundberg Method of Electrical Prospecting Successfully Applied

IN VIEW of the fact that considerable interest has been aroused in connection with the mining property under development by American Smelting & Refining Company, in Newfoundland, at Buchans River, our representative has obtained the following authoritative statement from H. A. Guess, the company's vice-president in charge of mining:

"The property, which is held on a partnership basis jointly with the Anglo-Newfoundland Development Company, Ltd., upon whose concession it is located, lies some 5 miles north of Red Indian Lake. The orebodies, which occur as a series of lenses along a zone, as so far opened up, of approximately 2 miles, are associated with andesites, andesitic porphyries, tuffs, and quartz porphyry. The ore is a very fine grained sulphide complex, varying somewhat at different points along the zone; and averaging, so far as now opened up, about as follows:

Gold, Oz.	Silver, Oz.	Copper, Per Cent	Lead, Per Cent	Zinc, Per Cent
0.03	3.0	2.0	7.0	16.0

"Baryta is a considerable component of the gangue. Some 3,000,000 tons have been indicated by the considerable diamond drilling and underground work so far done.

"At the time of acquisition, two orebodies of moderate size were disclosed at the surface. The additional bodies, which were covered by glacial drift and other material, were found by electrical prospecting, the Lundberg method being used and the work being carried on by the Swedish American Prospecting Corporation. The largest ore lens, which will be the orebody upon which mining operations will be centered for the first few years, outcropped at surface, with no covering other than soil and glacial drift. This orebody is a flat-lying deposit of considerable surface area, and, at the outset, will be mined by glory holes. Through connecting drifts at the bottom of these glory holes, the ore will be trammed to a skip pocket in a vertical shaft some distance removed, and, on being hoisted, will be dumped into a crushing plant and passed on to the mill.

"The construction program, which is now under way, includes a selective flotation mill of 600 tons' daily capacity, a hydro-electric plant of 2,000 to 2,500 hp. on Buchans River alongside, the water being led from storage dam to power plant by a 6-ft. steel penstock, 5,800 ft. long. Also included is a 22-mile railway taking off from the Anglo-Newfoundland Development Company's Millertown branch, at a point 15 miles west of Millertown Junction. In addition there are the usual shops, staff houses, workmen's cottages, and other buildings. Construction began with the opening of the season last spring; the railway is now completed and the power plant will be by the end of November. The mill, which is of steel and concrete, will be ready for production sometime next summer.

"A storage building of steel construction is also being provided alongside the mill, and another one at the port of Botwood, 90 miles distant, for storage of the concentrates during the four months, or thereabout, that navigation from the port of Botwood is closed. It is contemplated that, for the present at least, the concentrates will be shipped to Europe for smelting.

"The property is known as Buchans mine and is being operated by Buchans Mining Company, Ltd., a subsidiary of A. S. & R. Co., incorporated for that purpose in Newfoundland."

Gold Ore and Tom Reed Companies to Sink Shaft

AT A JOINT MEETING of the boards of directors of the Gold Ore and Tom Reed mining companies of Oatman, Ariz., the Gold Ore board agreed to finance the sinking of a three-compartment, 1,000-ft. shaft near the Aztec vein on the Tom Reed estate. The work will be done from the Black Eagle shaft as a base. This shaft is 400 ft. deep, and from it there is a drift which extends into the territory near the Aztec vein. From the end of the drift a raise will be put up to surface; the raise will be enlarged into a three-compartment shaft, which will then be sunk to a total depth of 1,000 ft. At that elevation connection will be made with the 700 level of the Aztec mine, where a large high-grade deposit is being mined.

The new shaft, besides making possible explorations at lower levels, will greatly reduce the cost of mining the Aztec bonanza. Ore from this ledge now has to be hoisted from the 700 to the 400 level through a winze, trammed to the American shaft, hoisted to the surface, and then hauled by truck to the Tom Reed mill. Most of this handling will be eliminated by the use of the new shaft. It is understood that the Gold Ore company, in return for sinking the shaft, will participate in the ownership of any new orebodies opened up on the Tom Reed estate by the new workings.

Hearing on Silver Suit Expected Within a Few Weeks

Argument is expected to be heard by Justice Wendell P. Stafford of the District of Columbia Supreme Court within a few weeks on the suit of the American Silver Producers' Association to compel the Treasury Department to purchase 15,000,000 oz. of silver at $1 per ounce to complete purchases under the Pittman Act. Attorneys for the silver interests are studying the government's answer to the suit and will soon decide on the form of their reply, which may be a demurrer or a plea in opposition to the government's position. Unusual interest is being manifested in the case.

Mexican Mining Company Leases Pinnacle Property

The Mexican Mining Company, a Nevada organization, has obtained a lease and bond on the old Pinnacle property, consisting of two claims on Bull Hill, in the Cripple Creek district of Colorado. In the past the Pinnacle was a consistent producer. The Mexican company, which is carrying on extensive operations on the Comstock lode, intends to develop the Pinnacle on a large scale, starting a drift on the 320-ft. level where specimens of high-grade ore were found.

Soviet Metallurgists Visit Butte Mining District

Party Making Six Months' Inspection Tour of Reduction Plants in This Country

A PARTY of Soviet metallurgists are making a tour of the various reduction plants in the United States, and expect to spend about six months in this country. Included in the number are N. S. Karitonyenkoff, president of the Altai Polymetal Trust of Moscow; P. W. Goncharoff, technical director and chief engineer for the organization of Ural copper establishments, with headquarters at Sverdlovsk; G. C. Mahovsky, assistant to the professor of the Institute of Mines at Leningrad; M. F. Ortin, professor of ore dressing in the Institute of Mines at Sverdlovsk, and S. E. Andreef, professor of ore dressing in the Institute of Mines at Leningrad. One of the members of the party visiting Butte stated that Russia now produces about 30,000 tons of copper annually, and its consumption, which now is 40,000 tons, is increasing steadily, last year showing a gain of 30 per cent over the previous year. The Russian government is attempting to bring production up to consumption and already has subsidized mining work to the extent of $250,000,000. When in Milwaukee the metallurgists gave an order to the Allis-Chalmers Manufacturing Company to equip a mine in the Ural Mountains.

Ardsley Butte Mines Corporation, operating the Highland group of claims in the southwest portion of Butte, in the week ended Oct. 29, shipped five cars of ore from its 350 ft. level and this week is producing at the rate of one car per day. The ore contains lead-zinc-silver and some copper. Within a short time the shaft will be put down to the 550-ft. point. As a result of the excellent discovery of ore on the property of the Ardsley Butte, the Butte Independent Mines Company has financed itself to further operate the Canadian group of properties lying west of the Ardsley Butte group. The Butte Independent Mines Company encountered ore on the 150 level, and has let a contract to sink the shaft to the 250-ft. point. John A. Roos and James La Fountain are in charge of operations. As a result of the developments in these two properties, it is reported that negotiations are underway by other companies to take over properties in the southwest portion of Butte.

W. B. Daly, general manager of mines of the Anaconda Copper Mining Company, Butte, at a public sale purchased the properties of the Butte-Jardine Metals Mines Company, situated in the Champion district near Race Track, Mont. Mr. Daly held a judgment or mortgage against the property for $134,986.78, and his bid represented that sum. It is believed that Mr. Daly was acting as agent for others in the transaction. At one time 150 men were employed on the property.

Majority Stockholders of North Butte Gain Point

MAJORITY STOCKHOLDERS of the North Butte Mining Company have gained one step on the minority holders in that Judge W. E. Carroll, of Butte, Mont., recently quashed the action of the minority holders to restrain the majority from holding a meeting for the purpose of amending the bylaws. Previous to the action of the minority interest, the majority held proxies for some 385,000 shares. However, the minority had cancelled the proxies on some 25,000 shares as shown by the meetings held on Oct. 24 and 25. At these meetings it was voted to change the headquarters of the company from Duluth to St. Paul and to amend the bylaws so that directors could be removed without trial and new directors elected to fill their positions. It was voted to remove three of the directors, including the Secretary, F. R. Kennedy, John W. Neukom, and W. F. Bartholomew. These directors will be allowed a hearing in the courtroom of Judge J. J. Lynch, of Butte, Mont. Specific charges will be made against these directors, and copies of the charges will be sent to them. The principal charges against the three named are that they caused the company to be unnecessarily put into the hands of receivers, and that Messrs. Kennedy and Neukom conducted the affairs at the Eastern offices of the company in an extremely expensive and negligent way. In short, the charges against Messrs. Kennedy and Neukom are active, whereas those against Mr. Bartholomew are only nominal.

Hazel and Bird Mines Under New Control

After being idle for many years, the Hazel silver mine, situated near Van Horn, Tex., has been purchased by Chester Bunker, of Fort Worth, president of the World Publishing Company. The consideration was $200,000. More than $500,000 of silver ore was produced in past operations at the property. New machinery and equipment will be installed and mining operations conducted on an extensive scale, it was stated.

Cecil Smith, of Sherman, Tex., and associates have taken over under lease the Bird silver-lead mines, consisting of three partly developed claims, 10 miles east of Alpine. New machinery and equipment will be installed. The mines are owned by Mrs. J. C. Bird.

Manganese Producers Establish General Offices

The American Manganese Producers' Association announces the opening of general offices in the Metropolitan Bank Building, Fifteenth St., opposite the U. S. Treasury, in Washington, D. C. All correspondence with the association should be directed to these general offices of the organization.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Attorney General Raids More Questionable Brokerage Houses in Ontario

TORONTO, OCT. 29—The Attorney General of Ontario is continuing the clean-up of questionable brokerage houses, and last week another concern, F. McLean Smith & Company, having offices at Toronto and Montreal, was raided and ten men were arrested. Operators of some gold mines in northern Ontario wish the Attorney General's department would pay the same attention to high-grading, which is extensively carried on in Porcupine and Kirkland Lake. They believe that considerable high-grading results from the laxity with which the offence is treated by the judges and juries. A recent outstanding case was that of W. P. Wilson, who was arrested with over $25,000 worth of gold in his possession, and who was known to have disposed of other gold valued at $125,000. His sentence consisted of only a $1,500 fine or six months in jail. This has aroused so much feeling that strong representations are being made to the government to see that proper action is taken. Last week another raid was carried out in Porcupine by the local and provincial police and ten men were arrested, several of whom were found to have a substantial amount of gold in their possession.

THE Dome mine of Porcupine has recently been running into some new ore, although it is believed that the bodies are not large, and, in fact, are not sufficient to compensate for the decrease in the available reserves. One of these new developments is on the 16th level, a long distance from any other workings. Values are erratic, but considerable free gold and tellurides are being found. Another section where new ore is being encountered is on the 9th, 10th, and 11th levels, and it is thought that the developments on these three levels are all on the same orebody. Despite reports to the contrary, no ore has been found on the 3,000 level, and, as a matter of fact, the porphyry is of much greater extent than anticipated, which is not a favorable indication. Earnings, however, are very satisfactory. Operating profits for the nine months ended Sept. 30 were $1,203,226, representing an increase of $36,000 over the corresponding period of last year. During the nine months' period, 406,700 tons of ore of an average grade of 7.21 was milled for a recovery valued at $2,930,251. Costs were $1,650,236, or $4.06 per ton milled. These costs include the sinking of a winze to the 3,000 level; at present operating costs are about $3.90 per ton.

On the Coniaurum property the shaft is practically completed to the 2,000 level, and crosscutting will soon be started at the 1,750 and 2,000 levels. The veins on this property are narrow, and a large amount of development work is required to open them up, so that the main levels are only being driven at 250-ft. intervals. The new ore on the 1,500 level has entirely changed the complexion of this property, and indications point to greater and more consistent lengths of higher-grade ore as depth is attained. Foundations are being put in for the new mill, which will have a capacity of 500 tons per day. The company, however, does not expect to treat more than 300 tons per day for some time.

Production on the McIntyre mines for the quarter ended Sept. 30 amounted to $981,251, an increase of $87,000 compared with the previous quarter. Net earnings before depreciation were $453,836, an increase of $77,700.

At the Lake Shore Mines, in Kirkland, the production for the quarter ended Sept. 30 was $765,000. The property milled 51,140 tons of ore for an average recovery of $12.51 per ton. Average daily tonnage milled was 660 tons. The mill is now treating over 700 tons per day, and a new tube mill is being installed, which is expected to give an additional milling capacity of 100 tons a day. Developments on the south vein on the 1,600 level indicate a higher-grade of ore than has formerly been found in this vein. Widths are running 9 to 10 ft., and the character of the ore has changed materially, so that it is now similar in appearance to the high-grade ore of the north vein.

Favorable developments continue at the Bidgood property, in the eastern section of the Kirkland district. A raise above the ore recently found on the 300 level has encountered more ore of good grade. A new plant is being installed, which will permit the speeding up of the company's underground operations.

The Cobalt Contact is meeting with favorable developments on the Ruby property, which was recently taken over by the company. On the 280 level, three new oreshoots have been located; these total 340 ft. in length. Additional crushing and flotation equipment is being added to the mill, which will increase the capacity and give better extraction. It is estimated that production for the year will be between 400,000 and 450,000 oz.

New finds in the Cobalt camp are comparatively rare occurrences these days, but at present the Mining Corporation has two new development faces in high-grade ore.

At the Nipissing mine, the recent rate of production is being maintained; for the three months ended Sept. 30, the company mined ore of an estimated net value of $263,362, and shipped bullion and Cobalt residues of an estimated net value of $277,140. The low-grade mill treated 20,386 tons and the refinery shipped 455,339 oz. of bullion.

Johannesburg Letter

BY JOHN WATSON
Special Correspondent

Value of Union's Mineral Output for Last Two Years Announced

JOHANNESBURG, Oct. 4.—A summary of the value of the Union's mineral production for the last two years, as recently announced by the government mining engineer, follows:

	1925	1926
Gold	£40,767,981	£42,285,139
Diamonds	8,198,128	10,683,597
Coal	3,862,118	4,046,620
Copper	514,219	494,852
Tin	304,552	310,899
Asbestos	152,115	216,466
Silver	166,898	126,580
Osmiridium	170,995	96,734
Platinum metals	.....	93,307
Corundum	13,229	44,871
Soda	13,480	22,970
Iron ore	.....	16,958
Chrome ore	21,001	14,623
Lead	55,966	5,726
Magnesite	4,007	4,211
Iron pyrite	3,400	3,376
Mica	4,577	2,969
Graphite	1,510	1,575
Manganese	817	744
Mineral paints	.....	607
Talc	262	385
Arsenic	790	122
Coke	92,643	106,153
Tar	8,441	15,466
Ammonium sulphate	11,920	10,680
Sandstone	22,852	22,923
Granite	55,952	18,849
Fluorspar	9,212	17,223
Gypsum	9,016	14,233
Slate	5,694	6,471
Fertilizers	1,453	2,257
Limestone	1,069	1,438
Verdite	.....	473
Feldspar	.....	240
Total values	£54,478,307	£58,694,781

THE total values of the mineral output for each of the four provinces follow:

	1925	1926	Increase
Transvaal	£46,139,048	£49,912,727	£3,773,679
Cape Colony	5,297,259	5,494,566	197,307
Orange Free State	1,187,962	1,252,577	64,615
Natal	1,854,038	2,034,911	180,873

According to a report from Port Nolloth, Cape Colony, the American Metal Company has closed down the mine at Copper Berg and dismissed the entire operating force. Many have also been paid off from Nababeep, and at Ookiep some salaried employees have been discharged. This will increase the number of unemployed in Namaqualand.

The thirty-second general meeting of shareholders of the Pretoria Portland Cement Company, Ltd., was held in Johannesburg on Sept. 23, with John Martin presiding. Owing to marked activity in the building trade, sales of cement exceeded the record established in the previous year. The Cape Portland Cement Company, Ltd., had a successful year, having declared dividends aggregating 7½ per cent. It has been decided to erect a cement factory at Port Elizabeth. The retiring directors, Messrs. E. G. Izod, C. Maggs, T. Marks and Sir Julius Jeppe, were re-elected.

From Cape Town, recently, 44 bags of tin concentrates, valued at £462, were shipped, by the SS. "Wakasa Maru." to Singapore.

Mexico City Letter

By W. L. Vail
Special Correspondent

Labor Troubles in Jalisco Reported Settled—Mines Working Normally

Mexico City, Oct. 26—According to a statement given out to the press by the Department of Commerce, Labor and Industry, having jurisdiction over mining matters, the troubles at the Amparo, La Mazata, Piedra Bola, Cinco Minas, El Favor, and other properties in the State of Jalisco have been amicably settled and all of these properties are now working normally. Miners of the C. R. O. M. labor faction, who were compelled to emigrate during the tense period of the troubles, have been permitted to return to their work, and presumably an agreement has been perfected between the dissentient union-labor factions. The attitude of the managements has been at all times that they were willing to converse with any union organization in a position to comply with its contracts. The federal government, in conjunction with state authorities, took a hand in the settlements, and it is hoped that they will be permanent. Aside from the kidnapping of W. E. Mitchell, general manager of the Amajac Mining Company, in the territory of Nayarit, and his early release on payment of 5,000 pesos ransom, there have been few disorders or molestations from banditry in these sections.

MINING taxes have been placed on a sliding scale dependent upon the quotations of silver in New York, according to a temporary amendment of the mining laws. When the price of silver is 60c. per ounce in New York City, the tax is 5 per cent, and when the price drops to 45c. per ounce, or less, the tax is changed proportionately. The Secretary of the Treasury is authorized to further adjust taxation in case the mining companies attempt to reduce the scale of wages. A special clause of the regulations, which are temporary, provides for a sliding scale on low-grade ores which run less than 8 pesos per ton.

All transactions in metals or ores must be manifested for purposes of taxation within 30 days following the close of each calendar month, according to a circular just issued by the Treasury Department. The period of 20 days formerly observed has been extended 10 days at the request of a number of mining companies which found the 20-day limit inconvenient in many cases.

A company is reported to have been formed with local capital at the City of Durango for the purpose of resuming operations on the Capricorio and Firmamento mines in the Inde district, State of Durango. Thomas J. Barbour, a local contractor, plans to drive a tunnel for the purpose of cutting the veins at a reasonable depth and facilitating the extraction of ore. The ores are reported to run high in silver and lead. They were excellent and profitable producers years ago. An attempt is also being made to revive the idea of continuing the old railway from the Descubridora mines, near the Central railway, to the Inde district. This line was projected several years ago, but was abandoned on account of the continued revolutionary activities throughout the district to be crossed. The road, if constructed, would open up a rich mineral district in the Sierra Madres of Durango, which is now almost inaccessible and outlawed to the poor miner.

On Oct. 29 a 1,600-meter tunnel of the Mazapil Copper Company at Aranzazo, near Concepcion del Oro, State of Zacatecas, was officially put into operation. The tunnel will unwater the present workings at 400 meters below the actual level of operations. The work was finished in six months and is pronounced to be a splendid piece of construction.

Governor Fausto Topete is reported to have reprimanded the municipal authorities at La Dura, Sonora, for interfering in the discharge of a number of workmen by the management of the American Mining Company, owners of La Dura Mine. An official investigation led to a complete justification of the company's action.

The West Mines, Ltd., district of Guadalupe y Calvo, State of Chihuahua, expect to resume work at their Rosario mining property soon, recent exploration having developed a large body of paying ore. The Oro del Cumbre property, in the same district, is installing modern machinery with the expectation of considerably increasing the output of the property.

The Socavon de Victoria, San Luis Potosi, which is being worked by the American Smelting & Refining Company on contract with the owners, is developing an extensive mineral zone and has now blocked out about 60,000 tons of ore. Exploration and development are being pushed.

Conditions throughout the State of Chihuahua continue to be increasingly favorable, according to statements from camps at Parral, Santa Barbara, and Santa Eulalia. Many of the larger properties are readjusting themselves to current labor conditions and metal prices, and expect to continue present operations.

General conditions at the Mazapil properties are said to be quite satisfactory; only the Saltillo smelter unit of the company is in any way affected by the depletion of the oxide ores. Other properties in the two states—Zacatecas and Coahuila—appear to be working in a normal way, and a few new denouncements and applications for concessions are reported.

Renewed activity is reported in the Sultepec and Zacualpan districts, State of Mexico, and at Taxco and adjacent districts of the neighboring state of Guerrero. Operations are quiet in the State of Michoacan.

London Letter

By W. A. Doman
Special Correspondent

Tin Interests Still Unable to Reach Workable Agreement

London, Oct. 25—An interesting stage had been reached in the tin position when my last letter was dispatched. No agreement had been arrived at, and in that respect the position is unaltered. Discussions, however, have continued and will do so for some time. At the end of the present week an official statement is promised by the parties who initiated the movement. The interests of the producers, smelters, consumers, and shareholders are all apparently represented. It would appear that certain high-cost producers, together with speculators, are playing the most prominent part. But even they are beginning to perceive that the scheme—if it is to come into being—is not going to have a smooth run first. Analogies of rubber and diamonds are quoted as being the latest combinations. These two are perhaps rather unfortunate selections. Rubber is on a different footing altogether, and diamonds are a luxury.

TO EFFECT a combination of producers in different countries, at different rates of production costs, with perhaps not always the same markets, is already bringing forward a crop of difficulties. The leading Malayan mines in British hands are the cheaply worked properties, and some of them are not desirous of being controlled. A very large proportion of the mining companies is owned by Chinese, and a large proportion of these again cannot be cheaply worked. To carry a stock of tin is an expensive matter, and it is the practice of the Chinese to sell to the smelters as soon as the concentrates are ready. To acquire control of these Chinese companies would be far from easy. The Orientals are keen bargainers, and might delay the scheme for a considerable period. They are aware of the proportion of tin which they contribute, and do not underrate their importance. The local smelters are not responsive to the suggestion, for their earnings would be diminished.

Presumably the scheme was discussed on this side before the East was consulted, for a cablegram received from Singapore says that Malayan opinion is skeptical as to the success of the scheme, and it is thought there is little likelihood of an agreement among the producers. Even those on this side who favored the suggestion at the outset are now becoming dubious, and certain metal merchants are confident that success is out of the question. One of the best-known and influential men in the tin-mining industry of Malaya considers that it would be suicidal to adopt any such impracticable scheme.

Societies, Addresses, Reports

Grand Falls power plant dam

The Eastern Tour of the Empire Mining Congress

By F. Lynwood Garrison
Mining Engineer

ALTHOUGH the island of Newfoundland was discovered by John Cabot in 1497, only five years after Columbus' famous voyage, and was the first part of North America to be settled by Europeans, it is today probably one of the least known sections of the continent. Its history is the history of the cod-fishing industry of North America, and for two or three centuries the importance of the island in this respect was second to none.

In early colonial times Newfoundland became a very important factor or element in shaping the policies of England in relation to her American dependencies, and thus, like eastern Canada, her history forms part of our own. Newfoundland was from the earliest times, and continues to be, an important source of fish-food supply for Europe, the West Indies, and South America. French interests there have always been important, and consequently frequent clashes with England resulted, not to be settled until England ceded to France, as a base for her cod-fishing industry, the little islands of St. Pierre and Miquelon, just off the mouth of Fortune Bay. This happened in 1763, when the Treaty of Utrecht was signed. It is interesting to recall that when the terms of this treaty were being discussed the English Ministry of the time seriously proposed to cede back to France the whole of Canada and retain the Guadeloupe Islands. In other words, to give up 3,729,665 square miles of territory and retain 722 square miles inhabited mostly by negroes. History records that this extraordinary stupidity was frustrated by a distinguished American named Benjamin Franklin. The Canadians have yet to erect a monument to his memory!

When the Empire Mining Congress party landed at Port aux Basques, Newfoundland, early in the morning of Sept. 11, its members were placed on a special train made up of excellent sleepers and dining cars which the Newfoundland Railway had set apart for them. This road, built some forty years ago by the Reid family, but now owned and operated by the government, is of narrow gage, and, coming from the standard cars so recently our home for over two weeks, it seemed Lilliputian, especially to the big, long fellows of the party. From Port aux Basques to St. Johns is 547 miles, and the scheduled time to cover that distance is 28 to 29 hours. The scenery as the train rolled along the shores of the Bay St. George that fine morning was extremely beautiful, mountains on one hand and the sea on the other. One could not but think that if a few of the hordes of people who rush every summer to see the stale sights of Europe realized what a wonderful and charming country there is in Newfoundland, right at their doors, they would ask for nothing better. The topography of the island is what geologists call "mature"—that is, although rugged, the contrast between mountain and valley is not accentuated. Very few of the mountain tops exceed 3,000 ft. above sea level. We passed the Bay of Islands, with its three arms extending 20 miles inland, one of which receives the Humber River, the second largest in the island. Here Blomidon Mountain soars majestically above the sparkling blue waters of the bay, with silvery waterfalls draping the neighboring crags; and, 'tis said, the best salmon fishing of Newfoundland is to be found hereabouts. In the early afternoon the train reached Corner Brook, or Humbermouth, where the large and modern paper mill of the Newfoundland Power & Paper Company is busily engaged in destroying the forests of this beautiful land, so that the fourteen-year-old minds of the average citizen may be duly enlightened and our city streets littered with waste paper.

The power plant of the afore-mentioned company, with its subsidiary power house and dam at Deer Lake, 30 miles up the Humber River, is said to represent an investment of forty million dollars. The mills produce 400 tons of newsprint daily and employ about 1,500 men. The amount of hydro-electric energy now being generated is about 100,000 hp., and, when the whole scheme is completed by further extension, it is expected, or at any rate claimed, that 350,000 hp. will be attained. At Millertown Junction, where we arrived about 7 o'clock, we were informed that anyone desiring to see the Buchans mine of the American Smelting & Refining Company could leave the

Portugal Cove, Bell Island in the distance

Entrance to an old slope at the Wabana mine

train then, or wait until the return trip from St. Johns. The fleshpots, good wines, and creature comforts of the fine modern hotel at St. Johns were a strong attraction, however, and we all said we would await the return trip, which some of us were destined not to make, and so failed to see Buchans. Grand Falls, the next point of interest, the official program tells us is the great Harmsworth pulp- and paper-producing industry which supplies the British public with a considerable proportion of its mental food and material to light its grate fires. This enterprise represents an investment of fifteen million dollars in town, plant, and power equipment. The output is 300 tons daily, which only partly suffices for all the Harmsworth publications in England. Between Grand Lake and Millertown Junction, previously mentioned, the train passes over an elevated area called the "Topsails," a rough, barren, granite stretch of country, reminding one of the old Missouri woman's remark "that thar land over yonder must be mineral land cause it aint good for nothin' anyhow." The promising Buchans mine is, however, in this vicinity, so, although one cannot well geologize from a moving railway train, there may be something in this remark.

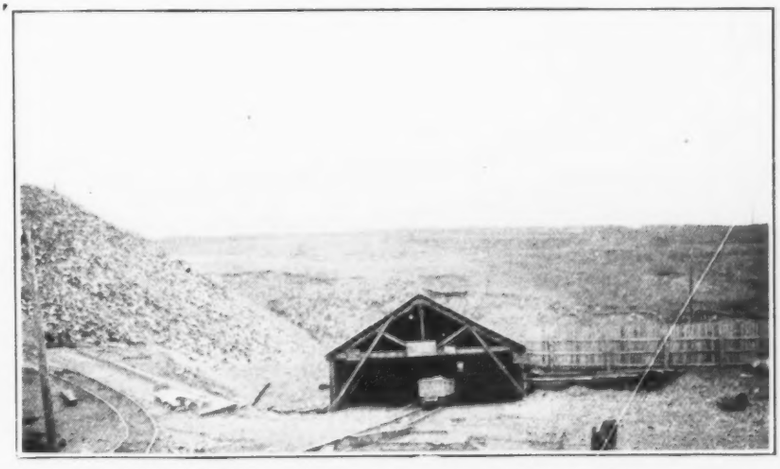
At St. Johns

During the night we passed Glenwood, on the Gander River, where it is proposed to establish another wood-pulp industry; plenty of water-power is no doubt available here. Monday morning, Sept. 12, found us comfortably settled in the beautiful new hotel at St. Johns, about the best little hostelry it has ever been our luck to find. Built by the government on modern plans, managed by a first-class experienced hotel man, it was thoroughly appreciated after our hard, strenuous trip of three weeks through eastern Canada.

The social activities and attentions of our kind hosts in St. Johns left us little time to ourselves. They evidently had not had many previous contacts with real mining men, and, if they had heard us singing *"Alouette, gentille alouette, Alouette, je te plumerai!"* as we did on the train the previous night, they might have imagined us a wilder crowd than they found us to be. Evidently our hosts were disappointed with our small numbers, so we tried to make up for that lack by being dignified and important. At the banquet the night of the day we arrived, they made it plain to us that their own ventures in mining had been unfortunate and that consequently their once enthusiastic interest in the game or industry had considerably diminished. It was necessary to dispel this illusion, and in this we hope we succeeded.

Our sojourn of three days at St. Johns was chiefly occupied with a technical session and a whole day's visit to the Wabana mine, on Bell Island, in Conception Bay, which mine at present is the only producing mine in Newfoundland. We reached the justly famous hematite deposit of Wabana by a short automobile drive to Portugal Cove and by small steamer from there to Bell Island. This great ore deposit consists of three distinct beds in sandstones and slates of the Ordovician. They vary in thickness from 5 or 6 to 20 ft., the Scotia or middle bed having a uniform thickness of 8 or more feet. The ore-bearing basin is said to be elliptical, with its major axis northeast and southwest, and 15 miles long and 8 to 9 wide. As most of the basin is under the sea, it would be interesting to know how these dimensions were obtained. A small portion of the south side of the basin is on dry land. The general dip of the beds is about 15 deg. to the north. The ore is a fine-grained oölitic hematite containing particles of quartz and fragments of fossils; it runs high in phosphorus and in this respect resembles the Clinton iron ores of Alabama. Average run-of-mine ore contains about 50 per cent iron and 10 to 12 per cent silica. The ore outcropping on the beaches or cliffs overlooking the sea has been practically worked out, the supply now coming entirely from the submarine operations, which extend several miles from shore. Three workable ore seams outcrop on the northern side of the island; the top seam, which is from 5 to 8 ft. thick, outcrops with very light cover and was extensively worked on its land areas. Fifty-eight feet below is the Scotia seam, which is of somewhat greater thickness and which has a considerably greater land area. The Dominion seam, 240 ft. below the Scotia, is thicker, but not so rich as the Scotia.

Eight slopes have been driven on these seams, four of which are now being operated. They are all submarine and vary in length from 2 to 3 miles. The ore is hauled out in trains of small cars as shown in one of the accompanying photographs. As a submarine iron ore mine Wabana is quite unique, the only similar mines being those of coal at Sydney and one or two in England. The roof is excellent, the changes of grade or dip being relatively slight in long distances. There is said to be practically no leakage from the sea above the mine; all the water flowing in is fresh and there is not much of it. The ventilation and roadways are excellent and well maintained. During recent years production has been around a million tons per year. Shipments were made to Sydney, and abroad to Great Britain, the United States, and Germany, the last-named country receiving lately the largest amount. The two loading piers are said to be each capable



Entrance to No. 3 slope at the Wabana mine

of handling 2,500 tons per hour and of accommodating the largest of freight ships. The mines are 2 miles distant from the shipping point, and the ore is transported to the piers by cableways and small cars drawn by rope haulage. On reaching the surface, all the ore is crushed to size.

The system here of undersea mining is simple but interesting. It is a modified form of room-and-pillar method, varying in dimensions according to the overburden and presence of faults, of which there are said to be few of importance. The rate of extraction on the land areas before the pillars were drawn was about 65 per cent, and by trimming pillars was increased to 85 per cent without caving; if caving were permitted the rate could be raised to about 92 per cent. In the submarine area, the extraction does not exceed 55 to 60 per cent. This can of course be increased by trimming pillars as far as safety will permit.

NEWFOUNDLAND A MIGHTY GOOD PLACE

The social attentions of our kind hosts and the government officials at St. Johns, from his Excellency Sir William Allerdyce, Lieutenant Governor of Newfoundland, and Lady Allerdyce, down to the most humble, were cordial, warm, and sincere. At 2 p.m. on Sept. 15, after a reception by the Rotary Club, our party boarded the train for the return journey to Montreal, where the trip began. Little Fred Foote and the writer, having decided jointly and severally that Newfoundland was a country worth knowing more about, were left behind to pursue their investigations for another fortnight. Their unanimous conclusion as the result of these further studies was that the ladies of St. Johns are charming, its men good fellows, the "Scotch" abundant, potent but potable; the salmon fishing unsurpassed, and the country as a whole a mighty good place for a mining engineer to prowl about and to find things of value and interest.

Rolfe Prize in Economic Geology Announced

C. W. Rolfe, professor of geology, emeritus, University of Illinois, has offered a prize of $250 for the most valuable contribution toward a new, better or increased use of any mineral resource of the State of Illinois. Unpublished results of study, or papers or books published since May 1, 1927, and before May 1, 1928, may be offered in the competition; but the results of the study must show real present or prospective economic value. The prize is open to anyone engaged in research, either privately, commercially, or in connection with any university or college staff, or any state or national bureau or survey. The work must have been done, or at least completed, during the year named.

Full information concerning the prize may be obtained from the Rolfe Prize Committee, 209 Transportation Building, University of Illinois, Urbana, Ill.

Create War Memorial to American Engineers

DURING the World War, many American engineers served overseas in the forces of the United States of America and the allies. A considerable number of them gave their lives, and for them the American Societies of Civil, Mining and Metallurgical, Mechanical, and Electrical Engineers will create a memorial by donating to the University of Louvain for its new Library building the clock and the carillon of bells for its tower.

Dr. Edward Dean Adams, of New York, honorary member of Engineering Foundation, ascertained the lack of clock and carillon last June while in Louvain as delegate from four American engineering societies, Engineering Foundation and Engineering Societies Library, to the celebration of the 500th anniversary of the university. Upon his return he proposed that these objects be given by the societies as a memorial to the American engineers who had made the supreme sacrifice "over there." The proposal was enthusiastically received, and a committee was appointed to represent the societies in carrying the project through.

Contributions of $5 or more, or any sums which donors feel able to give, may be sent to the Committee on War Memorial to American Engineers at once or not later than Feb. 1, 1928, at 29 West 39th St., New York City.

Wyoming State Mining Congress Meets at Casper

With 150 delegates in attendance, the State Mining and Industrial Congress held at Casper, Wyo., Oct. 27-29, appointed a general committee of eleven to consider the problems of the mining industry of the state. The committee was instructed to meet as soon after Jan. 1, 1928, as possible, and, when in readiness to make recommendations, to call a second mining conference for the specific purpose of discussing and acting upon such recommendations.

The following papers were presented at the meeting:

"Wyoming's Leading Industry," by John G. Marzel, state geologist; "Modern Geological Investigation," by G. F. Loughlin, geologist, U. S. Geological Survey; "The Mineralization of Medicine Bow Range, with Special Reference to the Centennial Mountain Platinum Deposits," by Andrew J. Hull, Wyoming Platinum & Gold Mining Syndicate; "Undeveloped Resources of the Big Horn Mountains," by George Haywood, Sheridan, Wyo.; "Obstacles Encountered in the Marketing of Mineral Products," by Ray E. Steffen, Casper, Wyo.; "The Platte County Plan for the Development of the Mineral Resources of the State," by A. B. Bartlett, former state geologist; "The Byron Plan of State Mining Development as it Would Apply to the State of Wyoming," by F. L. Byron, prospector, Casper, Wyo.; "Mineral Resources of Natrona County," by G. R. Hagens, Casper, Wyo.; "The Geology of the Metal-Bearing Rocks of Wyoming," by Dr. S. H. Knight, professor of geology, Wyoming State University; "Local Asbestos and Asbestos Products," by Fred Patee, Casper, Wyo.

Nicholas Longworth to Address Mining Congress

Nicholas Longworth, of Cincinnati, Speaker of the National House of Representatives, will be the guest of honor and principal speaker at the banquet to be held at the Mayflower Hotel in Washington on the evening of Dec. 2 in connection with the thirtieth annual convention of the American Mining Congress, which will be held Dec. 1, 2, and 3.

Meetings of the standardization division and of its committees will be held at the convention. Invitations to attend or appoint delegates to the convention have been extended to heads of government departments, state governors, deans of mining schools, and bank presidents.

Arrangements have been completed for an Internal Revenue Bureau "hour" at the convention. David H. Blair, Commissioner of Internal Revenue, has authorized two officials of the bureau to participate in this feature, which will be held at the morning session on Dec. 3. These officials are S. P. Hatchett, chief of the engineering section of the bureau, who will conduct a discussion on mine valuation, and W. T. Cardwell, assistant chief of Section G of the consolidated audit division of the bureau, who will be the leader of a discussion of audit questions involved in mining cases.

At the session devoted to consideration of the anti-trust law, the relation of the law to the lead and zinc industry will be discussed.

Dr. E. H. Wells, president of the New Mexico School of Mines, of Socorro, will speak on the mineral industry of that state.

British Columbia Branch to Meet at Vancouver

The annual general meeting of the British Columbia branch of the Canadian Institute of Mining and Metallurgy will be held at Vancouver on Nov. 23 and 24. Mining developments of the province will be reviewed by J. D. Galloway, provincial mineralogist; Victor Dolmage, head of the local branch of the Canadian Geological Survey; and the six resident provincial mining engineers. A symposium on flotation will be introduced by W. B. Timm, of the federal department of mines. This will be participated in by Dale L. Pitt, general manager of the Premier mine; T. Oughtred, of the Sullivan mill; and H. A. Pearce, of the Britannia mill. A banquet has been arranged for the evening of Nov. 24.

Personal Notes

ALEXANDER ANDERSON recently returned from a four months' business trip to Europe.

ARTHUR W. JENKS is en route to Colombia, where he will conduct an examination of several mining properties.

PERCY REID, Gold Commissioner of the Yukon, has come east for medical treatment and is a patient in St. Michael's Hospital, in Toronto.

J. P. NORRIE, formerly manager of the Stadacona Rouyn Mines, Ltd., has been placed in charge of operations at the Malartic, near Amos, Quebec.

J. B. GOWEN, JR., of the geological staff of the Anaconda Copper Mining Company, Butte, has been transferred to the company's properties in Poland.

STANLY A. EASTON, manager of the Bunker Hill & Sullivan, has been in central Idaho examining the quicksilver mine which that company recently acquired near the town of Warren.

P. G. BECKETT, general manager of the Phelps Dodge Corporation, has returned to Arizona from a two months' business and pleasure trip to England, Scotland, and the Eastern states.

DOUGLAS MUTCH has been appointed consulting engineer for the St. Anthony Gold Mines, Ltd., recently incorporated to operate the old St. Anthony mine, in the Sturgeon Lake gold fields of northern Ontario.

G. RAY BOGGS, of Death Valley Junction, Calif., was recently in San Francisco, where he discussed non-metallic minerals with the San Francisco Section of the Institute.

E. E. BARKER, engineer of mines, and J. D. SHILLING, superintendent of the Utah Copper Company, have gone to Salt Lake City after making an examination of the asbestos properties of the Johns Manville company.

ALFRED BERGMANN, manager of the Kupfer Import Gesellschaft and representative of the interests of the Anaconda Copper Mining Company in Berlin, is in the United States for a visit of three or four weeks.

WILLIAM ANDERSON, of Anderson & MacKay, consulting engineers, is making an examination of the Aconda-Kamiskotia property in the Kamiskotia area of northern Ontario, where an important discovery is reported.

Major General Sir FREDERICK D. W. LOOMIS has been elected president and general manager of the Power & Mines Corporation, Ltd., operating in the Michipicoten area of northern Ontario, in succession to J. A. JACOBS.

CLEVELAND O. MOSS, for the last three and one-half years mining engineer and geologist for the Stratton lease, at Cripple Creek and Victor, Colo., has resigned his position and will take a short vacation at his permanent address, 1730 Williams St., Denver, Colo.

HARRISON SOUDER has resigned as general manager of the Bethlehem Mines Corporation, Cornwall division, a position which he had held for 22 years, the last 11 years under the Bethlehem Steel Company. He will resume private consulting practice. Mr. Souder is succeeded at the Bethlehem mines by his former assistant, ARTHUR F. PETERSON.

Dr. W. KUPFERBURGER, government industrial research scholar of the Union of South Africa, recently arrived in the United States to make a study of the base-mineral industries of the country. His work here follows a six months' study of these industries in England. Prior to his government service, Dr. Kupferburger was a faculty member in the department of geology of the University of the Witwatersrand.

DR. W. KUPFERBURGER

SHERWIN F. KELLY, of Schlumberger Electrical Prospecting Methods, has returned to New York City from a trip to British Columbia and the Pacific Coast. In the course of his trip Mr. Kelly spoke on the general subject of geophysical prospecting, and electrical prospecting in particular, before the Vancouver section of the Canadian Institute of Mining and Metallurgy, the Seattle Mining Club, and before the students and faculty of the College of Mines and Engineering of the University of Arizona.

A CORRESPONDENT in Australia is seeking the address of DAVID GOUGH, interested in silver mines in North or South America. He originally came from Somerset, England. Anyone having information concerning Mr. Gough is requested to communicate with his nephew, David Gough, "Irvine," Merthyr Road, Pew Farm, Brisbane, Queensland, Australia.

OBITUARY

Mrs. ANGELINE CROWELL GROVE, mother of Clark Grove, secretary-treasurer of the Mine & Smelter Company, of New York, died at her Denver home on Oct. 27, aged 77.

Sir WILLIAM GALLOWAY, mining engineer, died in Cardiff, Wales, on Nov. 2. Sir William suggested, in 1898, the use of stone-dust in preventing colliery explosions, but the method was not generally adopted until eight years later.

NICHOL S. CLARK, president of the West Gold Mining Company, died at Denver, on Oct. 28. Mr. Clark went to Denver from Canada about six years ago and took over the West concern and as a mining engineer had been responsible for its development and operation.

A. E. RUSSELL, manager of the Maria Elena nitrate plant of the Anglo-Chilean Nitrate Co., in Chile, was, according to a recent dispatch, murdered late last month by a native dentist in the course of an altercation respecting the concession held by the dentist to practice at the camp.

JOHN P. TREADWELL, discoverer of the Treadwell mine, in Alaska, died in New York on Nov. 6. For years Mr. Treadwell had not been active in the mining business. He was 85 years old. The Treadwell gold mines were believed to have yielded more than $25,000,000 in ore. They are at Douglas Island, off the Alaskan coast, and with his brother, James Treadwell, J. P. Treadwell developed them.

LEON FEUCHERE, well-known mining engineer of Bisbee, Ariz., died at Long Beach, Calif., on Oct. 28. Mr. Feuchere, who was 49 years old, was a graduate of the Sorbonne (France), and went to Bisbee in 1912, to accept a position as geologist in the engineering department of the Copper Queen branch of the Phelps Dodge Corporation. About 1921 he severed his connections with the company to engage in leasing in the Bisbee district. Mr. Feuchere, who made his home at Warren, Ariz., is survived by his wife and mother.

CHARLES E. ROGERS, well known to the older mining engineers who operated in South Africa and Australia as well as in the United States, was accidentally killed while hunting on a small island in the river near his home at Whitney Point, N. Y., on Nov. 1. Mr. Rogers graduated from Cornell University as a mechanical engineer, but has followed the mining industry during most of his life, spending many years in Australia, from which he later removed to Johannesburg. For some time he was with Fraser & Chalmers, of London, but recently gave up his foreign connections, removing to his childhood surroundings at Whitney Point, where he bought and refinished an old homestead. He leaves a wife and three daughters, the eldest having entered Cornell this fall, and a host of friends who will mourn his untimely death.

Imports and Exports of Ores and Metals in August and September, 1926 and 1927

Compiled from U. S. Department of Commerce Records. In Pounds Unless Otherwise Stated

Imports

	August		September	
	1926	1927	1926	1927
Antimony				
Ore { Gross weight	551,375	84,220	612,759	304,257
Ore { Antimony content	307,213	51,130	317,927	149,130
Liquidated regulus or metal	2,279,839	1,614,315	2,265,353	1,209,575
Copper				
Ores, copper content	7,114,408	8,201,554	15,939,601	10,153,023
Concentrates, copper content	1,581,753	4,382,172	3,205,304	6,572,935
Regulus, coarse metal, cement copper	.....	344,746	7,407	172,891
Imported from				
Spain	456,792	642,633	852,958	286,074
Canada	4,460,971	3,117,553	6,724,283	7,296,890
Mexico	1,379,817	2,234,574	2,290,604	3,048,250
Cuba	.....	2,160,000	2,107,898	2,328,893
Chile	2,310,084	4,523,042	5,199,064	3,658,490
Peru	50,065	107,922	105,578	154,954
Other countries	38,432	142,748	1,871,927	125,298
Unrefined black, blister, converter copper in pigs, bars and other forms	28,781,325	32,895,890	53,249,454	39,714,672
Refined copper	12,560,164	4,661,433	16,501,349	4,560,555
Old and clippings for remanufacture	965,761	701,910	543,307	657,516
Composition metal, copper chief value	80,247	.....	15,084	13,995
Brass				
Old and clippings for remanufacture	891,708	496,235	557,347	600,452
Lead				
Ore and matte	9,672,937	7,351,855	11,411,868	5,344,689
Bullion or base bullion	8,707,641	29,144,666	22,004,352	18,922,414
Pigs, bars, and scrap	2,147,511	457,240	1,206,721	2,667
Babbitt, solder and other forms, lead content	147,426	72,431	67,310	132,457
Type metal, antimonial lead { Gross weight	264,338	56,664	288,013	.....
Type metal, antimonial lead { Lead content	193,455	35,699	199,915	.....
Manganese				
Ore, tons { Cuba, manganese content	.....	92	.....	187
Ore, tons { Other countries, manganese content	37,219	22,964	18,167	36,029
Pyrites, tons	11,849	28,583	23,867	17,547
Tin				
Ore, tons	40	11	13	7
Bars, blocks and pigs	11,495,065	19,174,412	13,646,182	11,060,281
Imported from				
Netherlands	448,322	2,349,584	1,288,911	1,131,750
United Kingdom	2,341,832	4,130,946	4,114,925	2,543,044
British Malaya	8,013,216	12,075,916	7,794,346	6,532,931
Dutch East Indies	175,562	.....	.....	.....
Hongkong	22,534	347,174	.....	527,407
Australia	100,800	78,400	224,000	190,400
Other countries	392,799	192,392	224,000	134,749
Zinc				
Ore, zinc content { Free	.....	1,400	.....	.....
Ore, zinc content { Dutiable	310,691	1,848,072	1,429,735	254,355
Blocks, pigs, and old	434	1,020	13,436	5,915

Exports

Copper				
Ores, composition, concentrates, unrefined	2,002,454	528,464	695,865	939,978
Refined copper in ingots and other forms	69,206,223	84,339,780	70,534,504	82,369,898
Exported to				
Belgium	7,621,775	9,047,347	5,720,114	6,101,518
France	10,762,913	8,415,525	11,946,234	12,528,601
Germany	15,841,970	21,481,339	13,925,478	14,516,125
Italy	6,760,232	6,045,671	5,213,857	5,773,233
Netherlands	8,889,258	8,708,766	5,088,345	13,171,394
Spain	235,329	78,668	1,187,690	215,429
Sweden	706,454	2,694,000	5,962,213	1,436,222
United Kingdom	11,206,910	16,158,910	12,295,240	21,275,609
Other Europe	742,124	4,531,459	1,938,591	3,640,618
Canada	511,353	2,015,778	826,763	1,835,574
British India	.....	.....	257,669	310,280
China, Hongkong, Kwantung	1,736,450	1,209,600	280,012	.....
Japan	4,044,395	3,191,430	571,800	333,735
Other countries	147,060	761,287	5,320,498	1,231,560
Old and scrap	1,482,550	3,262,671	1,711,113	3,377,851
Pipes and tubes	209,751	381,140	560,006	172,605
Plates and sheets	387,251	485,145	499,165	368,005
Rods	3,302,727	3,741,706	6,53[illegible],567	5,323,594
Wire	894,476	930,757	1,667,655	662,064
Insulated copper wire and cable	1,792,646	2,061,671	2,254,072	1,600,744
Lead	13,435,192	30,095,424	11,080,457	26,436,376
In pigs, bars, and other forms	11,453,656	29,413,935	106,505	437,106
From domestic ore	47,180	1,036,279	10,973,952	25,999,270
From foreign ore	11,406,476	28,377,656	.....	112,002
Exported to				
Belgium	224,034	134,443	918,621	1,254,684
France	448,089	784,180	2,240,508	5,736,628
Germany	2,912,917	10,810,856	1,120,286	1,344,184
Netherlands	224,048	1,803,623	448,085	784,211
Sweden	896,248	952,254	3,360,899	13,164,838
United Kingdom	2,353,159	7,730,227	.....	560,074
Other Europe	.....	1,288,970	11,296	449,061
Brazil	.....	224,041	202,469	844,183
Other South America	199,909	1,436,779	100	336,563
China, Hongkong and Kwantung	1,400,952	1,120,861	2,577,311	1,611,023
Japan	2,744,889	2,913,319	200,882	238,925
Other countries	49,411	214,382	.....	.....
Other lead manufactures	1,981,536	681,489	2,196,657	935,014
Zinc				
Ores and concentrates, tons	6,141	3,629	5,016	500
Dross	1,111,104	1,603,807	1,858,684	577,303
Cast in slabs, blocks, or pigs	7,903,965	9,615,181	10,701,800	9,346,607
Exported to				
Belgium	168,000	56,000	168,000	111,969
France	1,008,339	582,491	336,038	1,120,938
Germany	713,992	3,501	112,032	44,868
Italy	1,008,561	.....	112,090	224,076
Netherlands	90,253	.....	.....	.....
United Kingdom	3,193,516	6,480,933	5,174,986	5,125,737
Other Europe	440	.....	.....	.....
Argentina	.....	897,787	.....	952,408
Japan	1,646,590	1,232,212	4,648,549	1,232,183
Other countries	74,274	362,257	150,105	534,428
Sheets, strips, other forms	658,857	637,722	662,714	788,316
Dust	201,902	261,090	160,866	131,394
Other zinc manufactures	218,401	1,134,277	281,541	151,850

The Market Report

Copper Buying Continues to Feature Metal Markets—Zinc Weaker

New York, Nov. 9, 1927—Copper is more bouyant than for many months, and large sales at advancing prices are the feature of the non-ferrous metal markets. Zinc, on the other hand, continues to show weakness; and price concessions have been made by anxious sellers to get business. Shading of prices by second-hands is reported in lead, which is only moderately active. Tin is easier; and silver, after a sharp advance to 57⅜c. on Monday, has quieted down. Antimony is easier, whereas quicksilver and the metals of the platinum group are unchanged.

Copper Now Quoted at 13½c.

Both domestic and foreign buying of copper have been excellent during the week ending today, and prices are better. Not for a long time have there been two active weeks in succession in the domestic copper market. The past week, however, not only follows a very good week, but is the third in the last four in which sales have been excellent. Some 13¼c. copper remained in the market on Thursday, but since then only a few small sales were made under 13⅜c. and there were offset by occasional lots which brought a little more than the even ⅜ figure. Most of the producers are asking 13.50c. today, but business has been slim indeed. A large proportion of the buying was on account of wire-drawing companies. This is an encouraging development because wire has been the weak spot in the copper market for several months. Most of the business was for delivery in November and December, but January and even February were represented. Copper Exporters advanced its price again to 13.80c. c.i.f., on Nov. 8; offers in the f.a.s. market are available at 13.50 and 13.55c.

Lead Unsteady

Though the principal sellers of lead have made no change in their quotations, which remain at 6.25c. in New York and 6.00c., St. Louis, these prices have been shaded to some extent, and the market cannot be called firm. The principal unsteadying influence is the weakness in London, though prices there have shown marked resistance to further decline whenever the price for prompt metal reaches £20⅛. Should it break below £20, it seems likely that lower prices would be seen here, as otherwise foreign bullion lead could be sold here at a profit. Though the American Smelting & Refining Co. contract price remains at 6.25c., New York, an occasional lot has been sold at 6.20 and 6.225c., prices which could no doubt be duplicated today were buyers interested. In the Middle West, dealers have sold as low as 5.975c. The market has been rather inactive, with manufacturers of blue-lead products, pipe, and paint the principal buyers.

Zinc Declines to 5.60c.

Sellers of zinc do not appear to be overly optimistic, and they have been cutting prices during the week to get business. According to one view the anticipated start of production of High-Grade zinc at the new electrolytic plant at Anaconda, early in the year, is a factor that disturbs the market. On the other hand, it is reported that curtailment in the Joplin district may be brought about presently by the shutting down of a number of the smaller operations. At $35 for concentrate it is argued that many of the less-fortunate producers are losing money and that they will discontinue production. On Tuesday and today sales have been made at 5.60c., and it is possible that this may have been shaded. High-Grade has been sold at 7.75c., New York, for small lots of spot metal.

Daily Prices of Metals

Nov.	Copper	Tin		Lead		Zinc
	Electrolytic, N. Y.	99 Per Cent	Straits	N. Y.	St. L.	St. L.
3	13.025@13.15	56.625	57.50	6.20@6.25	6.00	5.70@5.75
4	13.15	56.50	57.25	6.25	6.00	5.70@5.75
5	13.15	56.25	57.00	6.25	6.00	5.70@5.725
7	13.15	56.00	56.50	6.20@6.25	6.00	5.65
8	Holiday	.....	.....	.....	6.00	5.60
9	13.175	55.75	56.25	6.25	6.00	5.60
	13.143	56.225	56.500	6.240	6.000	5.669

Average prices for calendar week ending Nov. 5, 1927, are: Copper, 13.077; 99 per cent tin, 56.500; Straits, 57.271; N. Y. lead, 6.242; St. Louis lead, 6.002; zinc, 5.754, and silver, 56.958.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; i.e., delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for ordinary forms of wire bars, ingot bars, and cakes. For ingots an extra 0.05c. per pound is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Nov.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
3	58 5/8	58 1/2	63	259 1/2	255 1/4	20 7/16	20 13/16	26 5/8	26 1/8
4	58 1/4	58 1/16	63	260 1/2	256	20 3/8	20 7/8	26 5/16	26 1/8
7	58 1/2	58 5/16	63	257 3/4	253	20 1/4	20 3/4	26 1/8	25 3/4
8	58 3/4	58 5/8	63 1/4	258 1/4	252	20 1/8	20 5/8	25 5/8	25 3/8
9	58 3/4	58 3/4	63 1/4	258 3/8	252 1/4	20 3/8	20 7/8	25 13/16	25 9/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Nov.	Sterling Exchange "Checks"	Silver		Gold London	Nov.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
3	4 86 3/8	57	26 3/8	84s11½d	7	4 86 9/16	57 3/8	26 7/16	84s11½d
4	4 86 9/16	57	26 1/8	84s11½d	8	Holiday	..	26 7/16	84s11½d
5	4 86 9/16	57	26 5/16	.....	9	4.86 9/16	57 1/8	26 3/8	84s11½d
					Avg.		57.100		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Tin Lowest in Two Years

The tin market has been quiet all week, and prices have declined to below 57c., the lowest level reached since the middle of 1925. Today's price of prompt Straits is 56¼c., with far-forward shipment about three-quarters of a cent less.

Foreign Exchanges Steady

Closing cable quotations on Monday, Nov. 7, were: francs, 3.92 11/16c.; lire, 5.46¼c.; and marks, 23.85c. Canadian dollars, 9/64 per cent premium.

Silver Touches 57⅜c.

The silver market has been more active during the last week, with prices holding steady until Nov. 7, when, because of large buying orders from India, the quotations rose sharply to 57⅜c. The market is less active today and closes quiet and uncertain.

Mexican Dollars (Old Mexican pesos)—Nov. 3d, 4th, and 5th, 45⅝c.; 7th, 44c.; 8th, holiday; 9th, 43¾c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified. London prices are according to latest mail advices.

ALUMINUM—Per lb., 98 or 99 per cent grade, price of leading interest, 25c.; outside market, 24.30@24.80c.

ANTIMONY—Per lb., duty paid. New York: Chinese brands, spot business, range for the week 11 to 10¾c.

Cookson's "C" grade, spot, 17¾c. Needle antimony nominally 8c. for lump and 10c. for powdered. White oxide, Chinese, 99 per cent Sb_2O_3, 15½c.

BISMUTH—Per lb., New York, in ton lots, $1.85@$2.10. London, 8s.

IRIDIUM—Per oz., $105@$108 for 98 @99 per cent sponge and powder. Market dull.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade) for single lots of spot metal.

PALLADIUM—Per oz., $52@$53. Small lots bring up to $56. Market very dull and prices easy.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $72. Dealers and refiners quote the trade for refined metal, per oz., cash, $64@$65. Market moderately active.

QUICKSILVER—Per 76-lb. flask, range for week $126@128, depending on quantity. San Francisco wires $128.67. London, £22½@£23.

RHODIUM—Per oz., $50@$52; London £8@£11½, nominal.

Prices of Cadmium, Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Nov. 5.

Metallic Ores

MANGANESE ORE—Per long ton unit of Mn. c.i.f. North Atlantic ports, minimum 47 per cent Mn. 36@38c. Caucasian, washed, 53@55 per cent, 40c. Chemical grades unchanged from quotations in the Nov. 5 issue.

TUNGSTEN ORE—Per unit of WO_3, N. Y.; Wolframite, $10.10@$10.35. Western scheelite, $10.35@$10.60. Market dull.

Chrome, Iron, Molybdenum, Tantalum, and Titanium ores are unchanged from quotations in the Nov. 5 issue.

Zinc Blende Again Lower Lead Unchanged

Joplin, Mo., Nov. 5, 1927

Blende	Per Ton
High	$43.95
Premium blende, basis 60 per cent zinc	$36.00@37.00
Prime Western, basis 60 per cent zinc	35.00
Fines and slimes, 60 per cent zinc	32.00@34.00
Average settling price, all zinc	37.87
Galena	
High	$82.80
Basis 80 per cent lead	80.00
Average settling price, all lead	81.15

Shipments for the week: Blende, 15,293; lead, 27,100 tons. Value, all ores the week, $799,220.

Sellers disposed of only 8,150 tons on the lower offerings, and it is reported that mills producing 2,000 tons per week will be closed indefinitely tonight. It is presumed that others will follow, unless a sharp cut can be made in operating expenses. Publication of the Producers' Association cost figures for August were released Thursday, and a drop of $3.51 per ton compared with July costs, is noted. July cost per ton of concentrate was $41.83; August cost was $38.32 per ton. The abrupt decline is attributed to the restarting of a number of mills in August for which supplies and repairs had been reckoned over a period of idleness. Another item is the large fleet of drill rigs idle, with a noted cessation of prospect and development work.

Platteville, Wis., Nov. 5, 1927

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$39.75
Lead Ore	
Lead, basis 80 per cent lead	$80.00

Shipments for the week: Blende, 935 tons; lead, 40 tons. Shipments for the year: Blende, 55,723; lead, 1,525 tons. Shipments for the week to separating plants, 1,937 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the Nov. 5 issue.

Mineral Products

ARSENIOUS OXIDE (White Arsenic)—Per lb., 4c. Market slack. London. Cornish white, per long ton, £18@£18¼.

Calcium Molybdate, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the Nov. 5 issue.

Ferro-Alloys

FERROMANGANESE—Per long ton, domestic and foreign, 78@82 per cent, $90, f.o.b. furnace, for delivery during second half 1927. Spiegeleisen, 19@21 per cent, $30@$31 f.o.b. furnace.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent, 92@95c. f.o.b. works. Dull.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, and Ferrovanadium are unchanged from prices in the Nov. 5 issue.

Metal Products

ROLLED COPPER—Per lb., f.o.b. mill, sheets, 22c.; wire, 15¼c.

LEAD SHEETS—Full rolled 9¼c.; clipped 10c. per lb.

Nickel Silver, Yellow Metal, and Zinc Sheets unchanged from prices in Nov. 5 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the Nov. 5 issue.

Steel Buying Mainly in Small-Lot Orders

Prices for Finished Products Softer—Pig Iron and Coke Dull

Pittsburgh, Nov. 8, 1927

Though the steel market is particularly lacking in large orders, except for contracts being placed in the annual rail-buying movement, the demand in small lots is insistent and holds up very well for the time of year. Hand-to-mouth buying is pursued with such increased closeness that it is possible the total number of orders is a new high record.

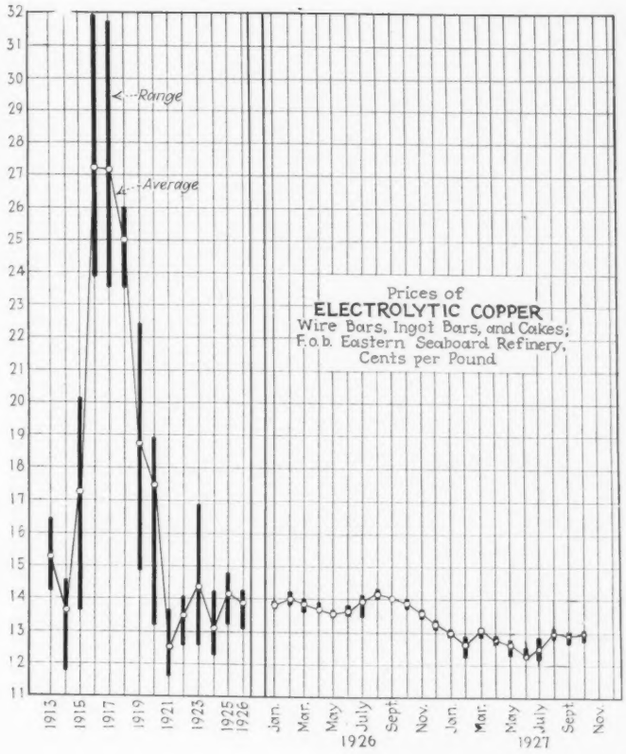
Mill operations reflect closely the current buying, and are at only slightly lower rate than in the last few months. Steel-ingot production was 82 per cent of full capacity in the first half of this year, and fluctuated between 65 and 70 per cent during the next four months. It is now a trifle below 65 per cent, but is hardly likely, with the seasonal decrease, to average below 60 per cent for this month and next.

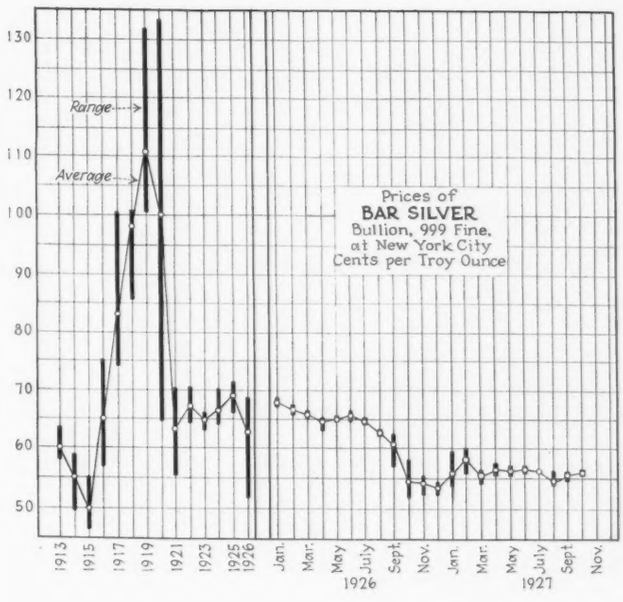
Finished-steel prices show a little additional softness from week to week. Recent slight declines in blue annealed and galvanized sheets are now followed by one in black sheets, now quotable at 2.80c. to 2.90c., 24-gage base. Plates are being shaded more frequently.

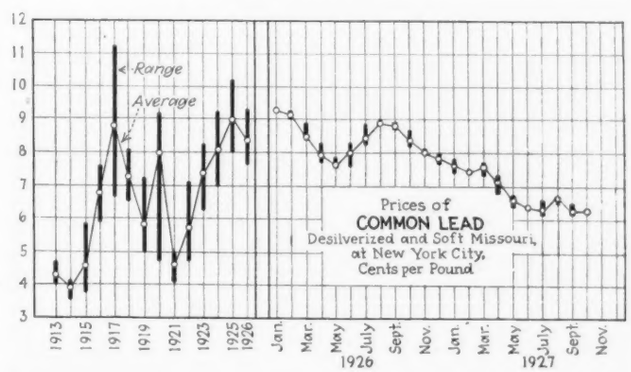
Pig Iron—The Valley pig-iron market is stagnant. Prices are not quotably changed, at $18 for bessemer, $17 for basic, and $17.50 for foundry, but are regarded as largely nominal.

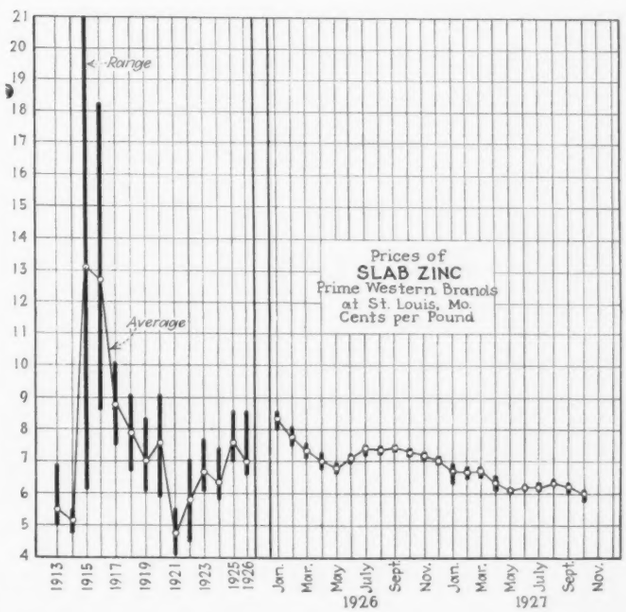
Connellsville Coke—The market continues dull with prices unchanged. Heating coke, $2.65@$2.75; furnace coke, $2.85@$3; foundry coke, $4@$4.75.

Metal Price Curves

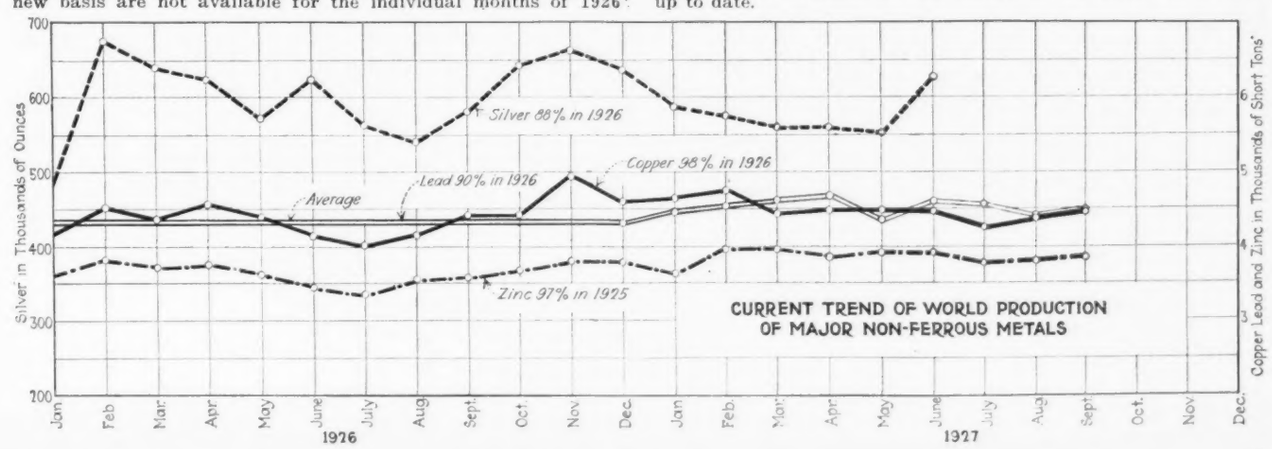








THE CURVES below are not to be considered as permanent records of production. They show merely the current trend in terms of daily output according to the latest estimates of the American Bureau of Metal Statistics. The figures represent production from countries that produce approximately 98 per cent of the world's copper, 97 per cent of the zinc, 90 per cent of the lead, and 88 per cent of the silver. The figures for lead on the new basis are not available for the individual months of 1926 and accordingly a horizontal line showing the monthly average reduced to a daily rate is shown. Delay in receipt of statistics from Mexico accounts for the failure of the silver curve to be up to date.



Review of Current Statistics

By A. B. Parsons
Associate Editor

As shown in the graph at the top of page 797, the *Engineering and Mining Journal* Index of Non-Ferrous Metal Prices sagged in October to 95.36, the lowest point reached since 1922, although the dip below the levels of June (95.55) and July (95.42) of the current year is so slight as to be almost negligible. The recovery of copper in August (followed by two months at an average just under 13c. refinery), caused the Index Number to climb temporarily, but the steady decline in lead, zinc, and tin during the last three months has a little more than offset the improvement in copper. This has been so in spite of the fact that copper is by long odds the most important factor on the Index Number, on a weighted basis. Comparing the individual figures for October with those for September, it appears that zinc, tin, aluminum, and lead, in the order named, contributed to the decline; whereas an advance in silver, together with a decidedly small improvement in copper, tended to lessen the extent of the decline.

The accompanying table discloses an interesting comparison between October average prices in the last three years. October of 1925 (115.64) was very close to the crest of the high-price wave; and October of 1926 (106.20) is about midway between the high and low levels of the corresponding month in the preceding and following years.

Nickel is a monopoly metal. Aluminum is in the same category to a large degree; but there is some competition by foreign producers. To what extent this foreign competition and other considerations not clearly understood by outsiders influenced the "trust" to cut its price twice in the last year is a matter for speculation.

Tin is unique in that the price for October in 1926 is much higher than that in either of the other Octobers shown in the table. The shrinkage in consumption for tin-plate manufacture in the domestic market, as a consequence of the greatly diminished demand for the canning of food products, has been the biggest factor in the world tin position; and a rapid and drastic decline has taken place in the last six months in spite of the efforts of speculative interests in London to keep the price up. The October average is a full 3c. lower than that of September.

Silver, as always, is in a unique position. The big drop reflected in the quotation for October of 1926 was brought about principally by political and economic developments in the Orient—revolution in China and revision of the currency policy in India. The subsequent recovery, though small, is encouraging to producers.

Of the three most important industrial metals in the non-ferrous group lead has declined most, followed closely by zinc. Copper is down, but not nearly so much as the other two. The production of each of these comes from many localities, the mines are operated by many companies, and the selling is in an open competitive market. Accordingly prices tend to respond more directly to changes in supply, consumption, and production costs than is the fact with the other metals. Lead and zinc in 1925 probably were "too high"; or at least that unprecise term could be applied to them more appropriately than it could to copper. The recent sustained declines in price are the consequence not so much of some shrinkage in the current demand as of the maintenance of rates of production at levels slightly above those of consumption.

Two differences may be noted in the position of copper: (1) It did not reach, relatively, as high levels in 1925 as the other two metals, and (2) stocks of metal in the hands of producers recently have been steadily reduced for a number of months as a consequence of judicious regulation of mine production. The current price level of close to 13.375c. delivered is in sharp contrast with the 12.50c. to which the price dropped for considerable periods earlier in the year. This is significant.

According to the index prepared by Irving Fisher, the level of general commodity prices has declined 7.1 per cent. during the last two years; this agrees closely with the tabulations of the Bureau of Labor Statistics at Washington. Generally speaking, therefore, aluminum, tin, and copper have declined about in line with other commodities; whereas lead and zinc do not appear so well by comparison.

Higher prices for asbestos are the biggest factor in the increase in the Weighted Index of Non-metallic Mineral Prices to a new high level of 106.75 in October. Some improvement in barytes also contributed to the result. Declines were recorded in borax, which is off ¼c. per pound, and in fluorspar.

Coincident with the decline in the general stock market that started early in October and continued through the month, mining shares fell off sharply, each of the accompanying index numbers showing material declines. In the mining - smelting - manufacturing group there was no single exception to the general trend. International Nickel, A. S. & R., and Anaconda did most to bring down the index number. The position of International Nickel has been influenced in recent months by technical market factors. The reaction in the others in the group can doubtless be ascribed largely to the prevailing trend of the stock market.

Three "coppers" were out of step with the other stocks: New Cornelia, Magma, and Miami show net gains for the month. Magma made the only decided advance, as a consequence no doubt of the reports of recent ore discoveries of importance. Kennecott subsided somewhat, but only temporarily, for since the figures on which the accompanying index is based were compiled it has reached a new "high."

The usual ups and downs are to be found in the miscellaneous group of gold-silver-lead-zinc companies. Hollinger, which had been falling off constantly from about $21, reached in April, reversed itself and made a small advance. Homestake, leading gold producer in the United States, made a sharp advance for reasons that are hard to find, unless it be a belated realization of the high yield at recent prices. Premier, Tintic Standard, and Silver King Coalition were the only other stocks to advance, possibly because of the strength of the silver market.

E.&M.J. Weighted Index of Non-Ferrous Metal Prices

100 Is Composite for 1922-3-4

1920	130.92
1921	80.80
1922	93.94
1923	103.43
1924	102.63
1925	111.74
1926	107.74

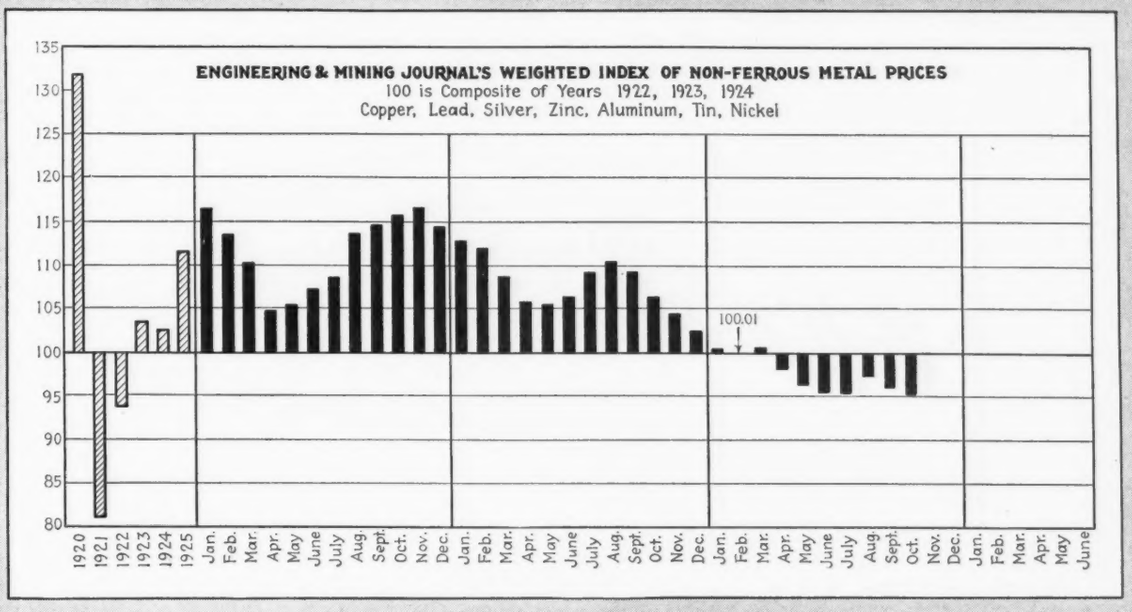
	1925	1926	1927
April	104.75	105.93	98.63
May	105.34	105.43	96.41
June	107.19	106.68	95.55
July	108.81	109.08	95.42
August	113.61	110.22	97.25
September	114.66	109.27	96.01
October	115.64	106.20	95.36
Average first ten months	111.01	108.63	97.59

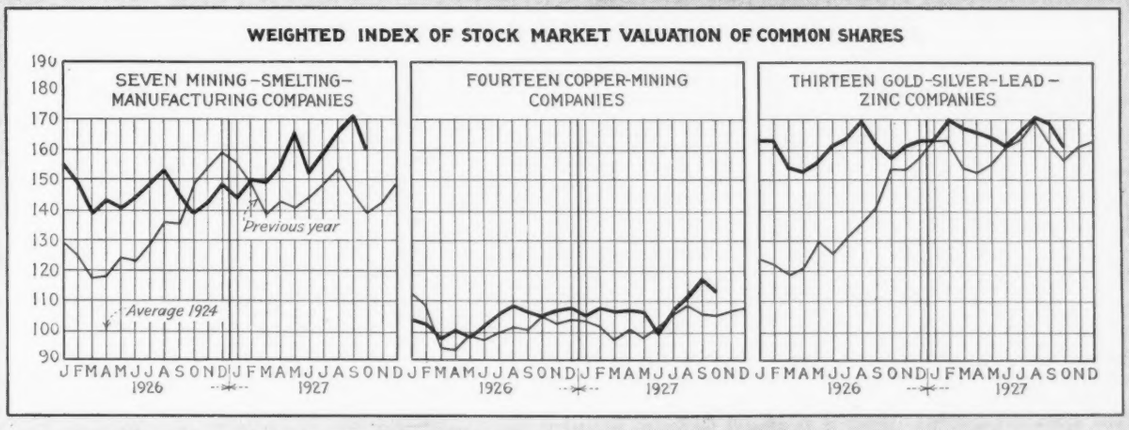
Comparison of Metal Prices

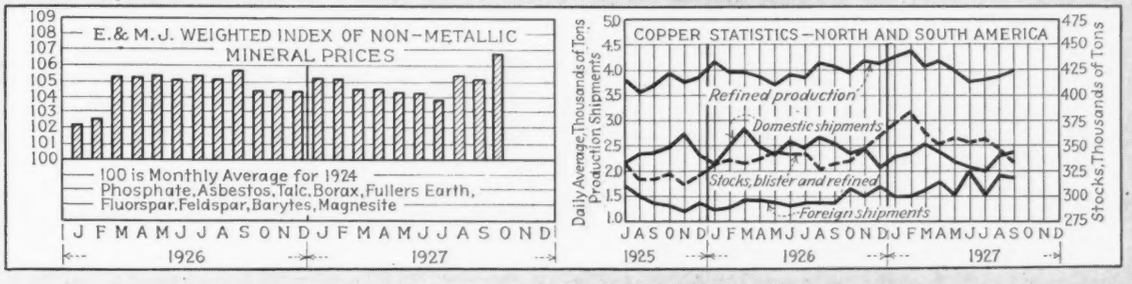
	October 1925	October 1926	October 1927	Per Cent Decline 1925 to 1927
Copper	14.30	13.86	12.96	9.4
Lead	9.51	8.40	6.25	34.2
Silver	71.11	54.51	56.04	21.2
Zinc	8.28	7.30	6.00	27.6
Aluminum	27.31	27.00	25.60	6.3
Tin	62.27	70.25	58.45	6.2
Nickel	34.00	35.00	35.00	(a) 3.0
E.&M.J. Weighted Index	115.64	106.20	95.36	17.7
Fisher's Price Index	156.7	148.7	145.6	7.1

(a) Advance.

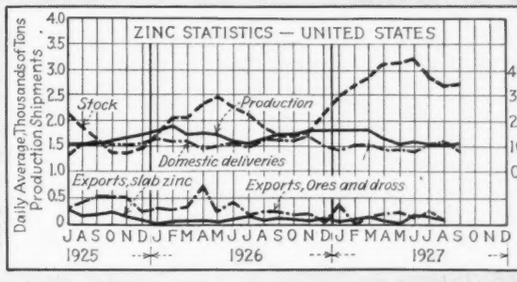
E.&M.J. Statistics of the Mining Industries

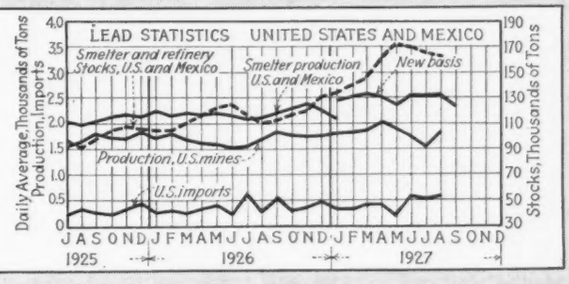

ENGINEERING & MINING JOURNAL'S WEIGHTED INDEX OF NON-FERROUS METAL PRICES
100 is Composite of Years 1922, 1923, 1924
Copper, Lead, Silver, Zinc, Aluminum, Tin, Nickel
100.01
1920 1921 1922 1923 1924 1925
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.


WEIGHTED INDEX OF STOCK MARKET VALUATION OF COMMON SHARES
SEVEN MINING–SMELTING–MANUFACTURING COMPANIES
FOURTEEN COPPER-MINING COMPANIES
THIRTEEN GOLD-SILVER-LEAD–ZINC COMPANIES
Previous year
Average 1924
J F M A M J J A S O N D J F M A M J J A S O N D
1926
1927


E.& M.J. WEIGHTED INDEX OF NON–METALLIC MINERAL PRICES
100 is Monthly Average for 1924
Phosphate, Asbestos, Talc, Borax, Fullers Earth, Fluorspar, Feldspar, Barytes, Magnesite
J F M A M J J A S O N D J F M A M J J A S O N D
1926
1927

COPPER STATISTICS–NORTH AND SOUTH AMERICA
Daily Average, Thousands of Tons Production, Shipments
Stocks, Thousands of Tons
Refined production
Domestic shipments
Stocks, blister and refined
Foreign shipments
J A S O N D J F M A M J J A S O N D
1925
1926
1927


ZINC STATISTICS — UNITED STATES
Daily Average, Thousands of Tons Production, Shipments
Stocks, Thousands of Tons
Stock
Production
Domestic deliveries
Exports, slab zinc
Exports, Ores and dross
J A S O N D J F M A M J J A S O N D
1925
1926
1927


LEAD STATISTICS UNITED STATES AND MEXICO
Daily Average, Thousands of Tons Production, Imports
Stocks, Thousands of Tons
Smelter and refinery Stocks, U.S. and Mexico
Smelter production U.S. and Mexico
New basis
Production, U.S. mines
U.S. imports
J A S O N D J F M A M J J A S O N D
1925
1926
1927

Mining Stocks—Week Ended November 5, 1927

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	48⅛	45½	48⅛	Oc.15, No.21 Q	0.75
Arcadian Consol.	Boston	1⅞	1½	1⅞		
Ariz. Com'l	Boston	5¼	5¼	5¼	Jy. 18, Jy. 30	0.25
Calaveras	N. Y. Curb			1⅞		
Calumet & Arizona	New York	95⅜	83	92½	Se. 9, Se. 26 Q	1.50
Calumet & Hecla	Boston	17	16⅛	16⅜	Au. 31, Se.15 Q	0.50
Cerro de Pasco	New York	68⅜	59¼	68⅜	Oc.13, No.1 Q	1.00
Chile Copper	New York	35⅞	33⅝	35⅞	De. 2, De. 30,Q	0.62½
Con. Coppermines	N. Y. Curb	3⅛	3⅛	3⅛		
Copper Range	Boston	15½	14	15	Ap.2, My.2, A	1.00
Crystal Copper	BostonCurb			*30		
East Butte	Boston	1¼	1¼	1¼	Dec., 1919	0.50
Granby Consol	New York	35⅜	32	34⅜	Jn.15 Jy. 1 Q	1.00
Greene Cananea	New York	85½	78	82½	Nov., 1920	0.50
Howe Sound	New York	39½	36⅛	38½	Oc.1, Oc.15, Q	1.00
Inspiration Consol	New York	19⅜	16⅞	18⅛	Ma.17, Ap.4, Q	0.25
Iron Cap	Boston Curb			1¼		
Isle Royale	Boston	13	10⅜	13	Se. 30, Oc. 15, Q	0.50
Kennecott	New York	78⅛	72½	77⅞	Se. 2, Oc. 1, Q	1.25
Magma Copper	New York	51	46¼	50	Se.30,Oc.15 Q	0.75
Mason Valley	N. Y. Curb	*84	*84	*84		
Miami Copper	New York	15¼	14⅛	15⅛	No.1, No.15, Q	0.37½
Mohawk	Boston	46	42	44½	Oc.31, De.1 Q	2.00
Mother Lode Coal	New York	1⅞	1⅝	1⅞	Jn.10, Jn.30	0.25
Nevada Consol	New York	17	15⅞	17	Se. 16, Se. 30 Q	0.37½
New Cornelia	Boston	23	22	22⅞	No.4, No.21 Q	0.50
Noranda	N. Y. Curb	25⅜	24⅜	25		
North Butte	Boston	1⅜	*95	1⅜	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	1	*95	*95	Sept. 1926	0.03
Old Dominion	Boston	11⅛	10⅛	11⅛	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb			118	Se.21, Oc.1 Q	1.50
Quincy	Boston	15	13½	15	March, 1920	1.00
Ray Consolidated	New York			15½	Ap.20, Ap. 30	0.25
St. Mary's Min. Ld.	Boston	26½	24	25	Fe.10, Ma.10	2.00
Seneca Copper	New York	1⅛	1⅛	1⅛		
Shattuck-Denn	Boston Curb			6⅛		
Tenn. C. & C	New York	8⅞	8⅛	8⅞	Au.31,Se.15, Q	0.12½
United Verde Ex	N. Y. Curb	26⅞	26¼	26⅜	Oc.6, No.1 Q	0.75
Utah Copper	New York			130	Se. 16, Se. 30 Q	1.50
Utah Metal & T	Boston	1	*76	1	Dec., 1917	0.30
Walker Mining	Salt Lake	*45	*43	*43		
NICKEL-COPPER						
Internat. Nickel	New York	68⅝	62⅝	68½	Se. 16, Se. 30 Q	0.50
Internat. Nickel pfd.	New York			109	Oc. 13, No. 1 Q	1.50
LEAD						
Gladstone Mtn	Spokane	*15⅞	*15½	*15⅝	June, 1927	0.005
National Lead	New York	118	115	118	Se. 16, Se. 30 Q	1.25
National Lead pfd	New York	112½	110⅜	112½	De.2, De. 15 Q	1.75
St. Joseph Lead	New York	37⅝	37⅛	37⅝	De.10,De.20,QX	0.75
ZINC						
Am. Z. L. & S	New York	6	6	6	May, 1917	1.00
Am. Z. L. & S. pfd.	New York	38⅝	36⅜	36⅜	Nov., 1920	1.50
Butte C. & Z	New York	4⅛	3⅞	3⅞	De. 9, De. 24	0.50
Butte & Superior	New York	9⅜	7⅞	8⅞	Se. 16, Se. 30 Q	0.50
Callahan Zn-Ld	New York	1⅜	1¼	1¼	Dec., 1920	0.50
Consol.Lead&Zinc'A'	St. Louis			11⅜	Ma.15, Ap.1 Q	0.25
Eagle-Picher	Cincinnati	25	24¼	24⅞	No.15, De.1 Q	0.40
Eagle-Picher pfd.	Cincinnati			117½	Jn.30, Oc.15 Q	1.50
New Jersey Zn	N. Y. Curb	184	181½	183	No. 19, De. 10 X	2.00
United Zinc	N. Y. Curb			*55		
Yellow Pine	Los Angeles	*35	*35	*35	Dec. 1925 Q	0.04
GOLD						
Alaska Juneau	New York	1⅛	1⅛	1⅛		
Argonaut	Toronto	*39	*32½	*38⅝		
Barry-Hollinger	Toronto	*94½	*92	93		
Con.W.Dome L.new.	Toronto	*16¼	*15½	*15⅝		
Cresson Consol. G	N. Y. Curb	2	2	2	Se. 30, Oc.10 Q	0.10
Dome Mines	New York	11⅛	10⅛	11⅛	Se.30, Oc.20 Q	0.75
Golden Cycle	Colo.Springs	†1.74	†1.73		Au.30, Se.10 Q	0.04
Hollinger Consol	Toronto	17.20	16.90	17.00	Oc. 19, No. 4	0.10
Homestake Mining	New York			71	No.19, No.25 M	0.50
Kirkland Lake	Toronto	2.76	2.50	2.74		
Lake Shore	Toronto	26.80	25.50	25.60	Se.1, Se.15 X	0.20
McIntyre-Porcupine	New York			28½	No.1, De.1 Q	0.25
Portland	Colo.Springs	†*25	†*20		Ap.6, Ap.15, Q	0.02
Rand Mines	New York			48⅛	Au.22-29 Am.sh.	1.52
Teck-Hughes	Toronto	10.85	10.50	10.73	Jy.21, Au.1	0.10
Tom Reed	Los Angeles	*40	*31	*31	Dec., 1926	0.02
Tough-Oakes	Toronto	*60	*53½	*56½		
United Eastern	N. Y. Curb	*50	*48	*50	July, 1924	0.05
Vipond Cons	Toronto	*60	*57½	*58½	Apr.1, Apr.15	0.03
Wright-Hargreaves	Toronto	7.40	7.25	7.25	Oc.17, No.1	0.05
GOLD AND SILVER						
Carnegie Metals	Pittsburgh	12	12	12		
Con. Cortez	N. Y. Curb			*23		
Dolores Esperanza	N. Y. Curb	*42	*36	*42	July, 1923	0.05
Premier Gold	N. Y. Curb	2⅛	2⅛	2⅛	Se. 15, Oc. 4	0.08
Tonopah Belmont	N. Y. Curb			1⅛	Ma.15, Ap.4	0.08
Tonopah Extension	N. Y. Curb			*11	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb			1⅞	Se.20, Oc.21	0.07½
West End Consol	N. Y. Curb			*7	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	*90	*45	*74	June, 1918	0.02
SILVER						
Beaver Consol	Toronto	2.06	1.85	2.06	May, 1920	0.03
Castle-Trethewey	Toronto	*81	*78½	*80½		
Coniagas	Toronto	4.55	4.00	4.30	May, 1924	0.12½
Keeley	Toronto	*82	*78	*81	Se. 1, Se. 15	0.08
Lorrain Trout Lake	Toronto			*60	July, 1925	0.05
McKinley-Dar.-Sav.	Toronto	*17¾	*17	*17	Oct., 1920	0.03
Mining Corp. Can.	Toronto	4.00	3.60	3.95	Jn. 29, Jy. 15	0.12½
Nipissing	N. Y. Curb	7⅛	7⅛	7¼	Se.30, Oc.20 Q	0.07½

Stock	Exch.	High	Low	Last		Last Div.
SILVER-LEAD						
Ahumada	New York	3⅜	3⅜	3⅜	Ma. 25,Ap.4,QX	0.12½
Bingham Mines	Boston	58½	56½	58½	Se.24, Oc.5 Q	1.00
BunkerHill&Sullivan	N. Y. Curb	125½	119¾	125	Oc. 31, No.4	0.75
Cardiff M. & M	Salt Lake	1.17½	*83	1.02½	Feb. 5, 1927	0.10
Chief Consol	Salt Lake	1.95	1.90	1.90	Nov., 1926 Q	0.10
Consti'nMng.&Mill'g	Spokane	*15	*15	*15		
Erupcion	Boston Curb			*60	Se. 15, Oc.3 Q	0.07½
Eureka Lily	Salt Lake	1.30	1.25	1.30		
Federal M. & S	New York	140	120	140	Jn.25, Jn.29	Spec. $10
Federal M. & S pfd.	New York	96⅜	93½	96½	Au. 25, Se.15 Q	1.75
Hecla Mining	N. Y. Curb	16½	15⅞	16⅛	Au. 15 Se 15 Q	0.25
Highland-Surprise	Spokane	*11⅜	*11½	*11⅜		
Iron King Mining	Salt Lake	*50	*49½	*50		
Keystone Mining	Salt Lake			*21	Au. 12, Au. 26	0.07½
Lucky Jim	Spokane	*32	*32	*32		
Lucky Tiger-Com	Kansas City	†7.10	†6.80		Oc.10, Oc. 20	0.05
Mammoth Mining	Salt Lake			1.40	Jn.10, Jn.20 Q	0.05
Marsh Mines	Spokane	*75	*75	*75		
North Lily	Salt Lake	3.00	3.00	3.00		
Park Utah	New York	7⅛	6⅞	7⅛	Se. 15, Oc. 1 Q	0.20
Plutus Mining	Salt Lake	1.40	1.40	1.40	Oc. 25, No. 10 Q	0.10
San Rafael	San Fran.	*8⅜	*7⅛	*7⅛		
Silver King Coal	Salt Lake	9.80	9.60	9.60	Se. 20, Oc. 1 Q	0.25
Silversmith	Spokane	*17½	*16⅛	*16⅛	Oct., 1926 Q	0.02
Strattons Mines	Spokane	*50	*45	*46		
Sunshine M. Co	Spokane	1.17	1.10	1.10		
Tamarack-Custer	Spokane	*32⅜	*29	*32½	Sept., 1924	0.25
Tintic Standard	Salt Lake	12.00	12.00	12.00	Se.15, Se.29 QX	0.40
Utah-Apex	Boston	4⅜		4⅜	Oct., 1926	0.25
IRON						
Bethlehem Steel	New York	51⅛	49	51⅝	Se. 2, Oc. 1	1.75
Cleveland-Cliffs Iron	Cleveland	101	95	99	Oc. 15, Oc. 25 Q	1.00
Colorado Fuel & Iron	New York	73⅞	68¼	72½	May, 1921	0.75
Gt. North'n Iron Ore	New York	25½	22⅞	25⅛	Dec. 6, Dec. 28	0.75
Inland Steel	New York	51⅝	50¾	51⅛	No. 15, De. 1 Q	0.62½
Replogle Steel	New York			12½		
Republic I. & S	New York	57	54½	56⅜	No. 15, De. 1 Q	1.00
Republic I. & S. pfd.	New York	99⅜	99	99	De. 14, Ja. 2 Q	1.75
Sloss-Sheffield S. & I.	New York			113	Se. 10, Se. 20 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	104⅛	104⅛	104⅛	Se. 20, Oc. 1 Q	1.75
U. S. Steel	New York	136½	129¼	136½	No. 30, De. 30 Q	1.75
U. S. Steel, pfd	New York	136⅝	135	136½	Oc.30, No. 29 Q	1.75
Virginia I. C. & C	New York			40⅛	Jan., 1924	1.50
Virginia I.C.&C. pfd.	New York			60½	Ju. 15, Jy. 1	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York			27½	Jn. 26, Jn.30	1.45
So. Am. G. & P. New.	N. Y. Curb			2⅜		
Alum. Co. of Amer	N. Y. Curb	97	96⅞	96⅞		
Alum. Co. of Amer.pf.	N. Y. Curb	104⅜	104¼	104⅜	Se. 15, Oc 1 Q	1.50
Vanadium Corp	New York	51⅛	50¾	51⅛	No. 1, No. 15 Q	0.75
Patino M. & E	New York	20⅛	20	20	Ap. 27, My. 5	1 sh.
ASBESTOS						
Asbestos Corp	Montreal	37⅛	36⅞	37⅛	Jan., 1926	1.50
Asbestos Corp. pfd.	Montreal	94⅝	94¼	94¼	Se.30, Oc.15 Q	1.75
SULPHUR						
Freeport, Texas	New York	92⅝	89	91½	Oc.15, No.1 QX	1.50
Texas Gulf	New York	70⅛	67⅝	69⅞	Ju. 1, Ju. 15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	41¼	36⅛	39	No.19, De.1 Q	0.75
Amer. Metal, pfd	New York			110	No.19, De.1 Q	1.75
Amer. Sm. & Ref	New York	168¾	159½	168½	Oc.14, No. 1 Q	2.00
Amer. Sm. & Ref. pfd.	New York	130⅝	128½	128½	No., Dec. Q	1.75
Consol. M. & S	Montreal	252	245	248	Jn. 30, Jy. 15 X	6.25
Newmont Mining	N. Y. Curb	105½	99½	105	Se.30, Oc.15 Q	1.00
U. S. Sm. R. & M	New York	39¼	37	39⅜	Oc. 6, Oc. 15 Q	0.87½
U.S. Sm. R.&M. pfd.	New York	49	49	49	Oc. 6, Oc. 15 Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange: Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED OCT. 25, 1927

Name	High	Low	Last	Date	Amount	Last Div.
Aramayo Mines (25 frs.)	75/7½	73/9	75/—	Nov., 1927	5	p.c. (†)
British Platinum (£1)	—/9	—/6	—/6	Feb., 1925	2½	p.c.
Burma Corpn. (10 rupees)	13 1½	12/6	12/10½	Aug., 1927	6	annas*
Bwana M'Kubwa (5s)	5/1½	4 6	5/—			
Camp Bird (2s)	3/9	3/3	3/6			
El Oro (£1)	3/10½	3/6	3/9	Nov., 1924	2½	p.c.*
Esperanza (10s)	—/2	—/1½	—/2			
Frontino & Bolivia (£1)	14/9	13/9	13/9	July, 1927	5	p.c.
Mexican Corpn. (£1)	7/6	6/9	7/6			
Mexico Mines of El Oro (£1)	17 6	16/3	17/6	Dec., 1926	3¾	p.c.*
N'Changa Copper Mining	10/—	9/—	10/—			
Oroville Dredging (£1)	6 3	6/—	6/3	Dec., 1923	¾	p.c.
Ouro Preto (£1)	2/6	2/—	2/—	May, 1925	2½	p.c.
Rhodesian Congo Border (£1)	45/—	31/10½	45/—			
St. John del Rey (£1)	10/9	10 4½	10/6	May, 1927	3¾	p.c.
San Francisco Mines (10s)	28/3	27/9	28/—	July, 1927	15s.	
Santa Gertrudis (£1)	17/7½	17/—	17/3	July, 1927	7½	p.c
Selukwe (2s. 6d.)	7/3	6/9	7/—	April, 1917	6¼	p.c
S. Amer. Copper (2s.)	1/10½	1/6	1/7	Nov., 1917	75	p.c
Tanganyika (£1)	64/—	57/6	59 4½	Aug., 1927	7½	p.c.
Union Miniere du Haut-Katanga (Brussels)	9.700	9.550	9.550	July, 1927	182.60	(‡)

* Free of British income tax. † Swiss francs and plus 15 p. c. bonus. ‡ Belgian frs. and free of taxation.

Industrial Progress

This Protective Coating Is Water Proof and Rust Proof

RUBBER and bitumen dissolved in benzol are the chief constituents of a new water-proof and rust-proof protective coating that has been introduced recently in Sweden. It is known as "Tillit." Additional ingredients make it dry rapidly, so that a hard and flexible surface may be obtained. Before being dissolved the bitumen has been subjected to an artificial oxidation, analogous to the preparation of linoleum from linseed oil, and it is then combined with the rubber by a special heating process. The oxidation of the bitumen removes its sulphur, imparting unlimited durability, and the combination with rubber results in great flexibility and power to adhere. The properties of the coating thus differ considerably from those of ordinary asphalt, which becomes brittle in course of time owing to the action of the air.

At the request of the Royal Swedish Water-power Board the State Testing Laboratory of Stockholm tested the new coating to determine its effectiveness as rust-proofing when compared with red-lead paint. The results are given in the table.

The Metallographic Institute of Stockholm has further tested the rust-protective effect of Tillit produced by coating iron-plate strips with it after they had been dipped in a salammoniac solution acidified with hydrochloric acid, a testing solution which is often employed as being a powerful rust-producer. Even after forty-six days the strips thus coated did not show any sign of rust, whereas those painted with red lead and linseed oil began to rust after seven days, and after fifteen days the coating could easily be detached by scraping with the finger nail.

The penetrating voltage was determined to be 9,000 to 12,000 volts with a coating 1/64 in. thick, thus demonstrating the entire absence of pores.

Tillit is being used in Sweden as a water-proof and protecting coating on concrete, brickwork, wood and felted roof; as rust-proofing for iron; as coating for ship bottoms, and as a preservative for belting and wire cables exposed to damp or corrosives.

It is further of interest to know that a special solution has been worked out which is intended for internal use in boilers to prevent corrosion and formation of boiler scale. The coating resists a temperature of more than 200 deg. C. without peeling off and the heat transmission is not diminished.

It is of great practical importance that the coating will adhere even to damp and rusty surfaces and can be applied in any kind of weather; further, that since the covering power per pound is about three times as great as that of red lead paint, the new coating is cheaper in use than any kind of oil paints in spite of the valuable properties that it possesses.

Hugo Tilliquist, Machine Agency, Stockholm, Sweden, owns the rights to this new substance. (The foregoing has been translated from *Teknisk Tidskrift.*)

Test	Tillit	Red Lead
Resistibility to air saturated with damp and containing SO_2; after 30 days' exposure	Good	The coating when dried could quite easily be scraped off in flakes.
Resistibility to acids; after being kept in 10 per cent hydrochloric acid for 10 days.	No corrosive penetration.	Penetration in some places.
Paint consumption for two coatings on sheet iron.	About 54 sq.ft. per pound	About 20 sq.ft. per pound
Drying capacity with thin coating on glass at 18 deg. C. temperature	Hard consistence within one hour.	Hard consistence within six hours.

A Hard Service Trolley Frog

A TROLLEY FROG for hard service in mines and industrial plants has been introduced by the Ohio Brass Co. of Mansfield, Ohio. It is known as the "M C B" trolley frog. This frog, the company announces, has been made to reduce wear and strain on the overhead wire, the trolley wheel, the trolley base, and the frog itself. It is designed to be placed nearer the switch point, thus permitting the wheel to follow more closely the direction of the car on the curve. This, it is said, will cut out much of the drag of the wheel against the wire, lessen the angle wear on both wire and wheel, and avoid unnecessary stress on the trolley base. The longer runners of the frog also keep the wheel on a natural track instead of allowing it to bump along where it will cut the pan of the frog and mushroom flanges

Ability to withstand hard service is a feature of this trolley frog

of the wheel. The frog is equipped with the company's bronze renewable cam tip, which, it is claimed, is a money saver.

The body of the frog is made of malleable iron with four pull-off eyes for tie-in of the span wires. Its runners are built high enough to keep the wheel flanges from cutting the metal between the pull-off eyes and frog body. A galvanized clamp with a ½-in. machine bolt anchors the device to the trolley wire. This (15-deg.) frog conforms to A.E.R.A. specifications. It is so designed that by correct placement, it will take care of practically all kinds of trolley turn-outs. It is made right and left-hand in sizes to fit 3-0, 4-0, and 6-0 round and grooved wires and 4-0 Fig. 8 wire.

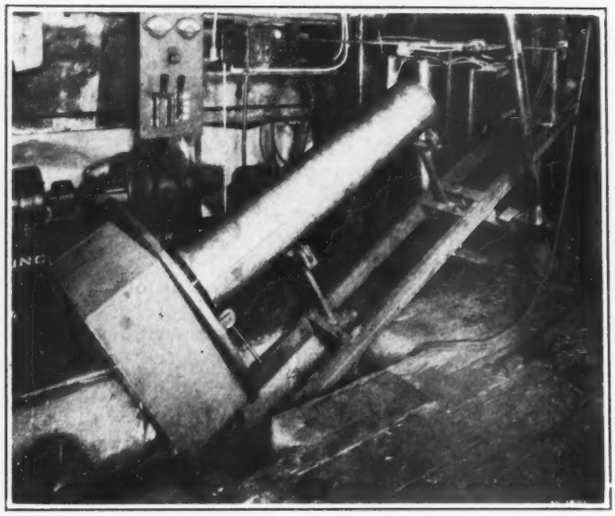
Transporting a Tractor on Mule Back

ALTHOUGH the light tractor has been pushing the horse and mule so completely into the background on the farm and in industry, it has remained for a California gold mine to develop an instance in which animal power was essential before the tractor could begin its operations.

Gordon F. Scheckler needed a tractor to work the Highland mine, in Siskiyou County, but the mine is 60 miles from a railroad, at an altitude of 8,000 ft. up a precipitous mountain trail. He purchased a Fordson, but obviously it was impossible to run the tractor up the mountain side; so it was knocked down to make the ascent on the backs of the mules. So narrow was the trail that the grouser plates had to be removed from the tractor wheels to permit passage between rocks and trees. On a stretch of 4,000 ft. some of the grades ranged from 25 to 30 per cent. The motor block of the tractor, weighing 235 lb., was loaded on one of the pack mules, and the docile animal carried it up the trail without mishap. Another load consisted of the transmission housing, which weighed 210 lb. When the parts reached the mine the tractor was assembled and placed in operation.

For Welding Small Tanks Automatically

The accompanying illustration shows a new "Stable-Arc" carbon arc, automatic welding machine that has just been perfected by the Lincoln Electric Company of Cleveland, for the purpose of welding the heads in small cylindrical tanks. The tank is mounted in an inclined position on a rotating table driven by a small variable-speed motor. Roller rests are provided which maintain alignment. The carbon electrode is carried by an adjustable arm supported from a rigid pedestal on which the motor starter is mounted. No filler metal is required in this operation; the head is flanged and inserted so that a lap joint is secured as in a riveted tank. The heat of the arc melts the edge of the lap weld of the cylindrical sheets, fusing it with the head and form-



This new automatic welding machine, together with two others previously introduced, make it possible to weld small tanks without hand welding

ing a solid, leak-proof joint. On 14-gage plate seams have been welded at the rate of 135 ft. per hour.

This is one of three automatic machines used in making cylindrical tanks. The other two are the carbon-arc, automatic welding machines for making the longitudinal seam and welding the bottom into tanks. With all three the entire tank can be made without any hand welding.

Chain Hoist Improved

EFFICIENCY, economy and long life in operation are claimed for the new Model K Cyclone hoist by the makers, the Chisholm-Moore Manufacturing Co., of Cleveland. The hoist is built on the gyrating yoke principle found in the earlier models made by the company. Improvements, however, give it a working efficiency of 90 per cent as against 80 per cent for the models previously produced, and, according to the company, a length of life, without repairs, longer than that of the old models.

In a series of tests, one of the new hoists was operated continuously for 320 hours. It was then thoroughly inspected. It was found that no repair parts were needed and only slight wear was noted on the working parts.

Among the improvements made in the hoist is the addition of anti-friction bearings at every rotating point. Altogether, eight ball bearings, four roller bearings, and one Timken thrust roller bearing in the lower swivel hook are used. One of the most important changes was in the four eccentric roller bearings. In the old models the rollers were loose and had to be carefully fitted into their cage when assembling. In the new model these roller bearings are in one complete unit, which form of construction does away entirely with the loose rollers.

The lift wheel is of a special steel alloy. All parts of the hoist are interchangeable. It is possible to assemble all parts without regard to "right or left," "upside or down," center punch marks, or other generally accepted means of matching parts.

Rapid Hack Sawing Possible With New Machine

A SAWING machine designed expressly to give the maximum possible output that modern high-speed steel hack-saw blades are capable of, has been introduced by Edward G. Herbert, Ltd., of Chapel St., Levenshulme, Manchester, England. With it a cutting speed of 200 ft. per minute can be obtained, which is nearly double the usual maximum speed of a hack-sawing machine. Within the last two years the same firm has developed the "Rapidor" high-speed steel blade, which, when used in existing machines, has given greatly increased output. This blade contains 18 per cent tungsten.

When run at 200 strokes per minute, or 200 ft. per minute cutting speed, with one of these blades, the machine has cut 3-in. round mild-steel bar in an average time of 3 min. 20 sec. per cut. The shortest time was 2 min. 9 sec. This was not too severe on the blade, which made about 35 cuts between sharpenings and a total of 690 cuts with one blade—that is, 690 cuts in an average time of 3 1-3 minutes per cut. When sawing 3-in. diameter brass bar under the same conditions it was found that 100 cuts could be made between sharpenings, and the average time was only 45 sec. per cut. With 15 or 20 sharpenings, 1,500 to 2,000 cuts are evidently possible with one blade. These outputs are greatly in advance of anything previously given by a hack-saw machine.

Quick operation has been kept in view in designing the new machine. The saw blade is strained by turning a handle, in a fraction of the time taken with a spanner, and a patent tension indicator shows when the blade is correctly strained.

All operations are controlled from one position in the front of the machine and all working adjustments are made from the same position. On the three-speed machine the speed changes are made by a handle at the front of the machine.

In operating this machine the pressure on the blade is not altered after adjustment to suit the blade, the material, and the speed. It has not to be altered during a cut because of variation in the width of the work, nor has it to be altered during the lifetime of a blade if the new blades are used, the manufacturer asserts.

When a blade is dulled, instead of adding pressure and forcing it to cut, it is taken out and resharpened, following the practice with all other cutting tools.

The vise, of the heavy screw type, has a loose jaw which swivels for holding taper work. It can be swiveled on the T-slotted table for making cuts at an angle or removed altogether and work bolted direct to the table. The screw is fitted with a ball-thrust washer, which lessens the effort required from the operator when fixing work.

Cuts can be started on sharp corners without damage to the blade by a patent control device operated by one finger. The common practice of filing a flat is obviated.

Fire-Fighting Equipment Makers Merge

Effective Nov. 15, the American-LaFrance Fire Engine Company, Inc., of Elmira, N. Y., has acquired the assets and good will of the Foamite-Childs Corporation, of Utica, N. Y., and the business of the two companies will be combined under the corporate name of American-LaFrance and Foamite Corporation.

For 82 years American-LaFrance Company has been recognized as the leader in the development and production of modern fire-fighting equipment. It has also produced a complete line of heavy-duty commercial motor trucks. Manufacturing fire-extinguishing appliances of all types, Foamite-Childs Corporation developed the modern *foam* method of fire-extinguishing.

CATALOGS

INSULATORS—Ohio Brass Co., Mansfield, Ohio. A 16-page pamphlet entitled "Lead Tip Steel Pins for Insulators." This bulletin treats of the importance of the pin to the insulator, placing particular emphasis on the necessity for proper pin selection to provide the most efficient insulator service. According to it, O-B pins are all knurled and hot-dipped galvanized before the lead is specially applied to insure a permanent bond so that the lead does not come loose on the pin. The cross arm, pole top, and separable tip pins are manufactured by this special process. O-B double-arm construction materials and double-pin pole top brackets are also described in the pamphlet.

PULVERIZED FUEL—Combustion Engineering Corporation, 200 Madison Ave., New York. A 4-page reprint of an article entitled, "Firestone Remodels Furnaces."